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Hob Corrections for Gear Tooth Modifications

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The use of gear tooth tip relief makes it necessary to design special hobs to produce the desired modification—Presentation of the first part of an analysis for such design

DUE to the elastic deformation of the material of gear teeth under load, there is a tendency to decrease the normal pitch where the teeth are coming into contact on the driving gear, and to increase it on the driven gear. Still greater differences may be caused by variations in manufacture. When the normal pitch is shorter on the driving gear, the teeth come into contact ahead of the proper position, thus tending to cause gouging of the dedendum of the driver by the tip of the driven gear tooth. This also causes impact and sudden acceleration, with a tendency to noise and wear. Where the normal pitch is greater on the driving gear, one tooth tends to carry the load and then drop it suddenly onto the next tooth. It is common practice, therefore, to relieve the tips of the teeth to smooth out unevenness in action due to the elastic deformation of the teeth and to variations in normal pitch within the manufacturing tolerances.

With the increasing use of tip relief on gear teeth, it is necessary to decide not only to what extent the tooth curve should be modified, but also what form of hob or other cutting tool is required to generate the desired shape. The different hob manufacturers apparently hold widely varying ideas of the proper solution of this problem, as indicated by Fig. 1, in which the Tooth Form Committee of the American Gear Manufacturers Association gives the normal sections of modified 14½-deg. hob teeth, as made by five concerns. Key numbers, rather than manufacturers' names are used. The accompanying table gives comparative data on typical gears produced by hobs modified according to each system.

System No. 1 uses an arc of a circle while the other four have straight line modifications on the hob. The pressure angles of the modified sections, or correction angles as they are called in this paper, are 17, 23½, 17½, and 30 deg. on systems Nos. 2, 3, 4, and 5 respectively, while the distances from the pitch lines to the ends of the 14½-deg. sections of the hob teeth are 0.500, 0.492, 0.600, 0.750, and 0.7571 in. These figures do not take into account the short radius which connects the pressure angle with the correction angle in system No. 5. It seems remarkable that none of the five systems should correspond in any particular.

The amount of relief on the circumference of the gear, called tip correction in this article, should be sufficient to eliminate impact under the greatest allowable differences in normal pitch. Larger tip corrections than this should be avoided as they produce an effect equivalent to cutting off the tops of the teeth. The depth of the relief on the tooth curve, which is here termed radial correction, should be sufficient to provide a gradual pick-up of the load. If the radial correction is too short compared with the tip correction, the load will be picked up suddenly at the beginning of the unrelieved section of the tooth curve, and the tops of the teeth might as well have been eliminated. On the other hand, if the radial correction is too long, the length of active tooth face may be reduced so much that the ratio of the arc of action to the circular pitch becomes less than one and continuity of action is lost.

When the point of contact passes from the relieved section to the regular tooth involute there will be some shock if there is much of a hump or change in direction. The angle between the tangents to the tooth involute and to the relief curve at the point where they come together is, therefore, of interest. It is termed entrance angle in this paper.

If a hob or cutter is used to generate the tooth shape, the tip correction, radial correction, and entrance angle will not be the same on the tooth as on the hob itself, and will vary for gears having different numbers of teeth. Any method of analysis must take this factor

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into account if it is to be of any practicable use.

This article is primarily concerned with the relation between the modification of the hob and that of the gear tooth, rather than with the proper form of tip relief, and gives the methods developed by the Brown & Sharpe Manufacturing Company. Equations and curves are given for determining the tip relief, radial relief, and entrance angle on any chosen size of gear when cut with a hob of known shape. Using hobs with straight line corrections, methods of determining the hob shape to yield to any desired tip and radial corrections, are developed. Curves for determining the number of teeth in contact and for showing the relation between normal correction and tip correction are also given. While the calculations are applied to hobs, many of the methods of the paper can be used in determining the shapes of other types of gear tooth generating tools.

Straight-Line Corrections

The straight-line type of hob correction is used on four of the five systems noted above and is, therefore, chosen for first consideration. In these systems the tip relief curve is an involute having a greater pressure angle than the tooth proper; and the distance between an extension of the correction involute and the regular tooth involute, measured on the pitch circle of the gear, must be the same as the corresponding distance on the pitch line of the hob. These are the two principal factors to take into account in the solution of this group.

In Fig. 2 is shown the tooth cross-section of a modified hob and of a gear tooth cut by this hob. In this illustration, as elsewhere throughout this paper, the nomenclature of the A.G.M.A is used as far as possible. On the hob tooth are shown the pressure angle VP, and the correction angle VC. The working addendum on a rack RWA is the distance from the pitch line to the end of the pressure angle line on the hob tooth and is the length of the perfect addendum on a rack tooth cut by this hob. The pitch line correction PLC is the name given to the distance intercepted on the pitch line by the tooth curve and the correction curve extended. The relation between these values is shown by the triangle drawn on the rack tooth and is given by the equation:

$$PLC = RWA \times (\tan VC - \tan VP) \qquad (1)$$

On the gear tooth the addendum A is divided into the working addendum WA and the radial correction RC. The tip correction TC is measured on the outside circle of the gear, while the normal correction NC is measured on a normal to the regular tooth involute, and is the shortest distance from the tip of the tooth to this involute extended. The angle between the tangents to the standard involute, and the correction involute at their point of intersection, is called the entrance angle VE and the

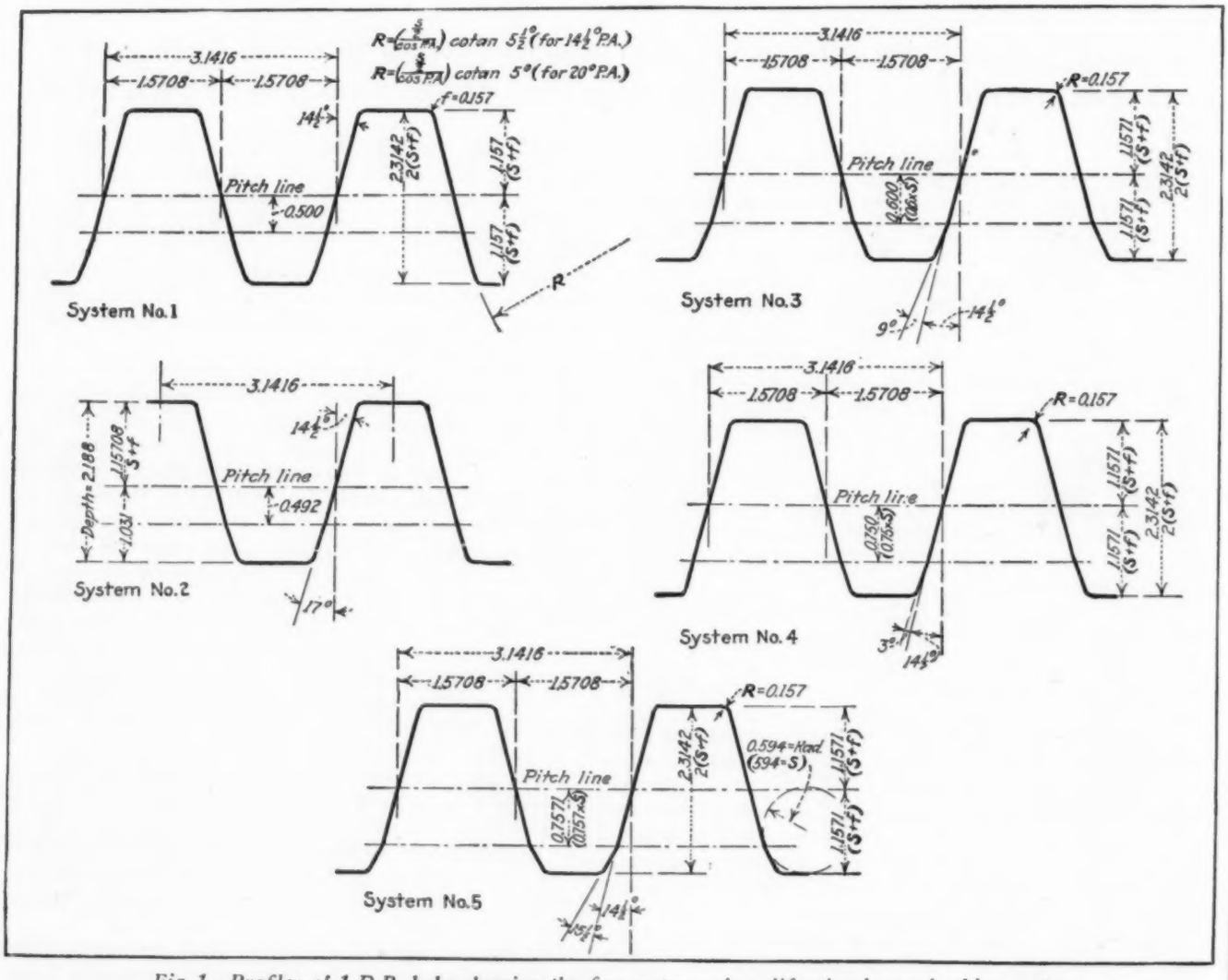


Fig. 1—Profiles of 1-D.P. hobs showing the five systems of modification in use in this country Key numbers are used instead of manufacturers' names

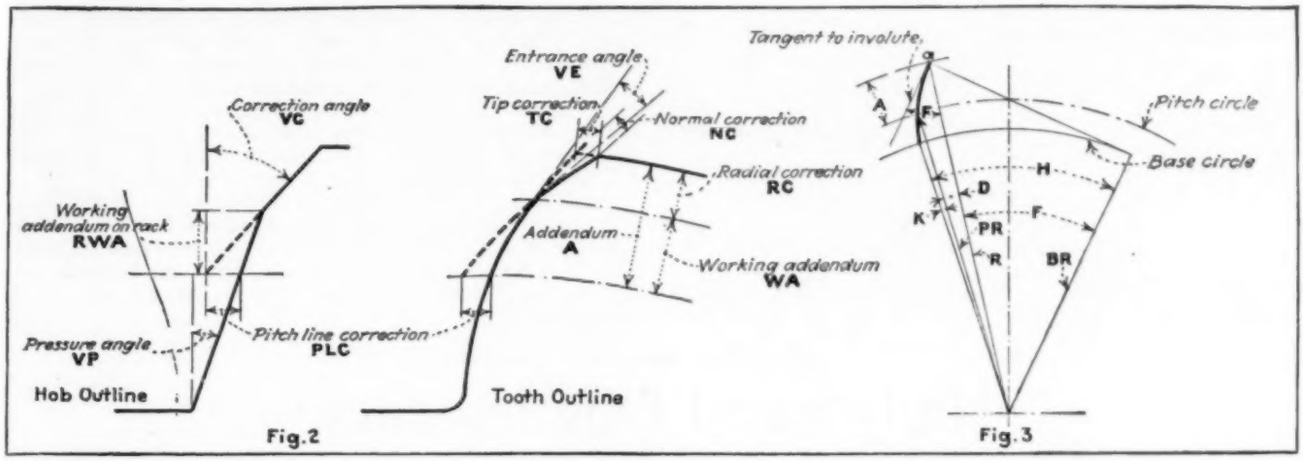


Fig. 2—Cross-section of the tooth of a modified hob, and cross-section of a gear tooth cut by this hob
Fig. 3—Relation between the addendum length and the involute angle

distance between these two involutes measured on the pitch circle is the pitch line correction PLC, this being the same as the corresponding dimension on the hob tooth.

The method used in this paper for determining the relation between the hob shape and the gear shape is based on the relation between the addendum length and the involute angle. Referring to Fig. 3, the term involute angle is applied to D or the angle about the center of the gear subtended by a section of the tooth involute, starting at the pitch circle and ending at any point a on the addendum. If this addendum length is expressed in per cent of pitch radius, values of the involute angle can readily be calculated for any pressure angle and any desired series of addendum percentages. The equation giving this relation is developed in the appendix to this part of the article.

The angle D is expressed in radians, as lengths on the pitch or outside circles can then be determined directly by multiplying the angle by the proper radius. If degrees are desired so as to get a better physical conception of the amount involved, the angles can be converted from radians by dividing by 3.1416 and multiplying by 180 degrees.

The next step is to get the angular differences between regular tooth involute and correction involutes for corresponding addendum values. Fig. 4 shows a given pitch circle of radius PR and outside circle of radius OR. Between these circles are drawn two involutes, ab for the pressure angle, and ac for the correction angle. Using the equation developed in the appendix, the involute angles can be calculated for each involute, and the angular differences determined for corresponding addendum percentages. A curve can be plotted then, using the addendum percents for abscissas and angular differences in radians for ordinates.

The correction involute does not go through a, however, but must be advanced the amount of the pitch line correction on the hob, shown as ad. This makes it assume the position def. Dividing the length ad by the pitch radius gives the angle in radians through which the correction involute is rotated from the first position, and laying this out on the curve noted in the previous paragraph gives the position of e expressed in addendum per cent.

The working addendum WA is found by multiplying this percentage by the pitch radius. The angular difference at the outside circle can also be determined readily

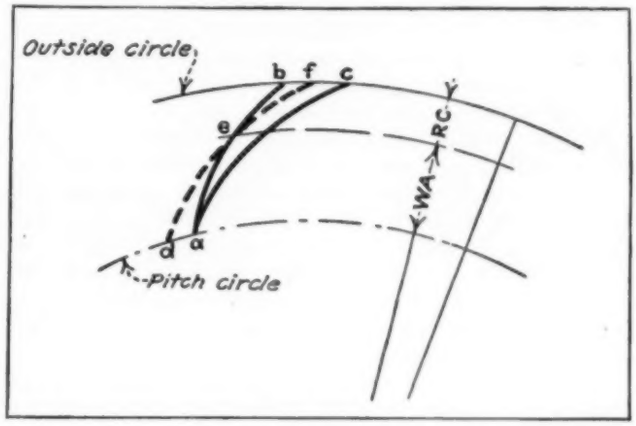


Fig. 4—Correction involute, and regular tooth involute curves

from this curve, and the tip correction bf is obtained by multiplying this value by the outside radius.

Appendix

Development of Equation for Involute Angle in Terms of the Pressure Angle and the Addendum in Per Cent of Pitch Radius

In Fig. 3 is shown an involute curve, and a is any point on that curve at an addendum distance A, and at R inches from the center of the gear. The length R is given by following equation, the angle being in radians.

$$R^2 = (BR)^2 + (BR)^2 H^2$$

$$H^2 = \frac{R^2}{BR^2} - 1 \qquad (2)$$

but $$BR = PR \cos VP$$

Length R can also be written as a constant times the pitch radius, or $R = C \times PR$

This is equivalent to saying that, if the radial distance on the addendum is 5 per cent of the pitch radius, the value of c is 1.05. Substituting these values in equation 2, the value of H becomes

$$H = \frac{1}{\cos VP} \sqrt{c^2 - \cos^2 VP} \qquad (3)$$

The involute angle D is given by the equation

$$D = H - F - K \qquad (4)$$

but $$\tan F = \frac{BR \times H}{BR} = H$$

or $$\tan F = \frac{1}{\cos VP} \sqrt{c^2 - \cos^2 VP}$$

Therefore, $$F = \tan^{-1}\left[\frac{1}{\cos VP}\sqrt{c^2 - \cos^2 VP}\right] \quad (5)$$

The value of K is given by the equation

$$K = \tan VP - VP \quad (6)$$

When these values are substituted in equation 4, the value of the involute angle becomes (7)

$$D = \left[\frac{1}{\cos VP}\sqrt{c^2 - \cos^2 VP}\right] - \tan^{-1}\left[\frac{1}{\cos VP}\sqrt{c^2 - \cos^2 VP}\right] - (\tan VP - VP)$$

Equation (7) gives the values of the involute angle D corresponding to any radial length on the addendum, provided this length is given in terms of percentage of pitch radius. At first glance it seems complicated but the same terms recur several times so that it is not a particularly long task to calculate the angle in radians to six or seven places for a succession of values of the addendum in per cent. The tangent to the involute at the point makes the angle F with the radius as indicated. The amount is given by equation (5) and is used in calculating the entrance angle.

Some time may be saved in calculating values of the involute angle and of the tangent angle by use of Table I entitled "Values of the Involute Function of α" published on page 555, Vol. 64, of the *American Machinist* in the series of articles on "Design of Gear Tooth Forms" by Earle Buckingham.

High-Speed Obsolescence

By A. W. Shaw

"WHAT was the most interesting fact you discovered?" I recently asked a man who had just been through the plant in which the big three-motored Ford airplanes are manufactured.

He answered without hesitation: "The fact that they can make but 10 machines exactly alike. Changes are coming so rapidly and improvements developing so continuously that in no other way can they keep abreast."

As an example of the speed with which something new is being perfected in the airplane industry that incident would be merely interesting, and probably of no great significance. But actually it is an example of the speed with which something new is being perfected in practically every line. As a matter of fact, therefore, it is extremely significant.

And furthermore—and, incidentally, of at least equal significance—it draws to the surface a factor of the day which is exercising an important influence on the underlying trend of business. This factor is the high speed of obsolescence.

Since everything about us is moving at new, high speeds—transportation, communication, money, inventories—it is perhaps not remarkable either that obsolescence should accelerate or that its change of pace should attract but little attention. However, the fact that the coming of high-speed obsolescence has attracted scant attention does not diminish its importance—an importance which, in my opinion at least, gives it rank alongside such major developments as hand-to-mouth buying, centralization of bank reserves, mass production, and chain-store merchandising.

Our most paraded bogy-man has perhaps been an alleged excess of productive capacity. There are many of experience who sincerely fear this bogy-man; who assert that "the good old days" were the piping times, that the country has seen its palmiest years, that the future holds merely a bitter and a dreary competitive struggle under a staggering, smothering productive capacity.

My point is that high-speed obsolescence goes a long way toward making a joke of this particular bogy-man. "In the good old days" buildings and machines were built with an idea that they were almost permanent.

Today, because all of business is accustomed to rapid developments corresponding to those which keep that airplane factory changing models, permanence is expected of neither machines nor buildings. A nine-year old skyscraper is torn down without appreciable hesitation, to make way for a better, bigger building. A stock of radio batteries is tumbled overboard as a matter of course in order to make way for new goods that operate from the house current, and a sizable part of this stock may in turn be tossed overboard in order to obtain sales on lines of completely self-contained instruments which merely require a single plugging into a light socket. The combine, tumbling a mass of farm machinery into the discard, is welcomed. A fleet of sleeping cars is laid off in order to introduce newer equipment containing beds in individual compartments. Investments of tens of thousands of dollars in machinery are quickly discarded in order that replacements may be made with models carrying new improvements.

And it is all accepted as a matter of course, since our viewpoint nowadays takes as a matter of course acceleration, the coming of the new to replace that which is less effective. No longer is the question involved one of "wearing out." Instead, it is a question of always using the newest and best.

The end result of this attitude is, of course, the creation of fresh markets constantly. And fresh markets mean new work for productive capacity. And new work for productive capacity is about all that is needed to make a joke of the over-production bogy-man.

But the effects of this attitude—this eagerness for the best and the newest—do not stop with a speeding up of obsolescence. It must not be forgotten that this country is by no means a completed job. It is a young country. There is an immense amount of work to be done improving and equipping it. For example:

1. Every wooden house of many types is a replacement probability.
2. Hundreds of improved bridges are to be built.
3. Electricity is called for on tens of thousands of farms.
4. Road building has scarcely begun, and even new roads must be widened in many instances.
5. Railroads have opportunities to install new types of cars, bearings, electric equipment, and safety devices; to lower grade crossings and reduce curvatures.
6. Heating and refrigeration replacements are in prospect for hundreds of thousands of homes.
7. Great public works are ahead—"improvements" on nature—such as the control of the Mississippi and the building of a Gulf-to-Atlantic waterway.
8. New types of furniture will replace the present

Abstract of an article in *The Magazine of Business*, September.

type of equipment in use in many of our households.

9. The educational plant must be expanded and brought up to date to care for the increased demand for education.

That list is by no means complete, yet it is amply long enough to demonstrate the tremendous investment in changes, improvements and replacements which this country will make during the years immediately ahead, an investment so tremendous that it assures American business its best years in the future, not the past. Of course the wherewithal must be available for the investment. And it is—the 14 billions of new capital added to our resources annually provide a pocketbook generous enough to satisfy easily the expense of high-speed obsolescence and constant purchases of the newest and the best.

Thus high-speed obsolescence, fortified by the call for improvements in many directions not directly involving obsolescence, undoubtedly supplies a back-log which is taking a great deal of the sting out of our increased productive capacity. The figures which are now available for the first half of this year certainly indicate something was amiss with the reasoning of those who felt, late in 1927, that the over-production sword had fallen on our necks.

And probably the best half of the 1928 story remains to be told. With a good record for the remainder of the year added to its showing to date, 1928 may well turn in final totals as a next-to-the-record year. And a next-to-the-record year means a year only exceeded by 1926 figures.

With any such record before use next January will not the over-production bogy-man be at a bit of a disadvantage? And will not some of those who have actually been frightened by him begin to look about for new factors which logically explain the country's apparently exhaustless consumptive powers?

My suggestion is simply that they consider placing among those factors high-speed obsolescence.

It is merely a suggestion, but perhaps one that will help them satisfy themselves as to exactly why the over-production bogy-man really was a bogy-man.

Depreciation at Cost or Replacement Value?

By E. F. Weimar
Assistant Cost Accountant
The De Laval Separator Company

WHETHER to take depreciation at original cost, or at replacement value, is the subject of much discussion among accountants and machine tool builders.

The staunch believers in depreciation at replacement value put forth the very good argument that new machines are costing considerably more than those purchased five or ten years ago. The manufacturer who does not provide adequately for this in his depreciation budget will find that he is not in position to make many replacements out of reserves which should have covered this contingency. The machine tool builders, no doubt, are the chief exponents of this method.

The adherents to the depreciation at cost basis advance the argument that, in the strictest sense of the word, very few if any machines are replaced. Machine tools of the present era are so greatly improved that they cannot be compared with machine tools purchased five or ten years ago. Furthermore, it does not seem reasonable to burden present production with the higher cost of equipment, which may or may not be replaced later.

There is something to be said on both sides of this question. It is certainly sound business to provide for the future in any line of endeavor. However, the inclusion of future expenditures in present day costs is questionable.

One solution to this problem might be to set up a reserve to cover the difference between depreciation at cost and depreciation at replacement value. This reserve should be taken from gross profits and not included in overhead charges. Such a method would provide the wherewithal for replacements, and yet not increase present production costs.

Progress and the Engineer

IN A remarkable paper on "A Century of Inventions," delivered at the recent centenary celebration in London of the Institution of Civil Engineers, Sir James Alfred Ewing prophesied that there would be a lull in the revolutionary progress of mechanical inventions, and that public minds would probably be turned more to the ethical side, and to the improvement of personnel in the immediate future.

Sir James observed that if progress were tested by the conquest of inanimate nature, then the century now closing might find no parallel in the past. He likened it to the effloresence of a plant which quietly grows to maturity and suddenly bursts into flower. What is left for the future engineer to do? What is to follow? Is the second centenary of the Institution, when celebrated, to show less progress than does the first? Transport, especially by air, may be made less perilous and more convenient. Communication may be extended to include vision; already we can half see. Power will certainly be more generally distributed.

But can the engineers of the coming century be expected to bring about developments in the application of natural resources comparable to those of the past hundred years? He doubted it. It seems more likely that there will be something of a lull in the revolutionary fervor of the engineer. The speaker forecast drastic social changes, but not so directly consequent on the activities of the engineer as in the century now ending. Mechanical devices will, of course, be increasingly used, but so standardized will they become as to be taken for granted.

Sir James appeared to think that the mental energy of mankind will seek and find outlets in other directions, particularly in ethical progress. We might regret such an issue, but it must be admitted that it might prove beneficial to the human race, since beyond question there is a grave need for progress of quite a different kind. All efforts to apply the sources of power in nature for the use and convenience of man, successful as they were in creating for him new capacities, new comforts, new habits, have left him at bottom much what he was before. This was proved when the war came and he realized the moral failure of applied mechanics.

In the diligent cultivation of their arts engineers have possibly forgotten that progress in them has far outstripped the ethical progress of the race. Surely it was for the engineer as much as any man to pray for a spiritual awakening, to strive after such a growth of sanity as will prevent the gross misuse of his good gifts. It is the engineer who has put into man's unchecked and careless hands the potentiality of ruin.

Vacations and Bonuses

BILL HOLLAND dropped in at the Business Men's Club for a quiet lunch, but John Harper of the Premier Gage Company, who was lunching with two other shop managers, asked him to sit in with them.

"We've just been talking vacations, Bill. I know it is a bit late for this year but there are other summers coming, and it takes some of us at least a year to make up our minds to a new plan. We've about decided that it pays to shut up the whole shop except for the repair crew, but we aren't at all agreed as to whether we ought to consider paying some of the best men for the vacation period. What do other shops do about it, Bill?"

"Most of them don't, Jack. But the notion seems to be growing that it's a good plan. Of course it amounts to an increase in wages for the men who get it, but it acts as a bonus, doesn't increase the wage rate and isn't paid if it isn't earned."

"How do they work it, Mr. Holland?" asked Frank Myers, of the Myers Foundry.

"Practice varies widely, of course. One concern I know gives a week's vacation with pay to everyone in the place who has been there a year. Those who have been there six months or more get paid in proportion to their length of service."

"What about the others—they lose a week's pay, I suppose?"

"This shop tries to take care of that by letting men who haven't been there long enough to earn their vacation wages, work with the repair gang who go over the machines and otherwise 'titrivate' the shop. Some are not fitted for actual repair work but they try to find something for them to do—such as cleaning up the place."

"But that leaves the man who has been on the job for five years in the same boat with the man who just comes over the year limit, doesn't it, Bill?" asked Harper.

"That depends on how you feel about it, Jack. This shop I mentioned has worked out a plan for the five-year men that pleased all hands this year. All the five-year men get a bonus in addition to the week's pay. The firm has made money and they are willing to pass a little of it to the men."

"That brings up another point, Mr. Holland. How did they work the bonus, give every man the same amount—or how?" This from Myers.

"That was their first idea, Myers. But one of the head men figured it out this way. 'We want to pay the men somewhere near in proportion to their value to us. If we give them a flat bonus we are paying them only for length of service. And while that counts and has a real value—it isn't much of an incentive except to stick to the job.' So he stuck out for paying each five-year man a bonus of a week's salary."

"Seems to me that favors the higher paid men. And the others may need it more," said Harper.

"Perhaps there's something to that, too, Jack. But we are talking about a man's value to the company, not how badly he needs extra money. We'd all like to see everyone relieved from worry about rent and doctor's bills, but we can't set wages on that basis."

"But didn't some of the lower salaried men feel it?"

"I presume they did. But the company issued a very nicely worded note about it. Said they had carefully considered it from all angles, and came to the conclusion that a man represented his value to the company, and that as this was a reward for services rendered, this seemed the fairest method."

"Good logic too, Holland. That appeals to me," said Myers. "Though I might go a step farther if I wanted to be real finicky. I'd be inclined to consider not only the present salary but the increase since the man started with me. If he came in at a low rate and had shown himself worth a rapid rise in rate, he's worth more to me than the man who came in at a higher rate but hasn't earned much more. The man who just keeps his job isn't worth as much as the man who grows with the job every year."

"You've given us something to think over, Bill," said Harper as they parted.

"That's good," answered Holland with a dis-

arming chuckle. "I just can't resist the temptation of remarking that if I've made you fellows exercise your gray matter a bit I've earned an afternoon off. It isn't everybody that could do a job like that. So long."

Executives are invited to discuss the problem involved in the foregoing case. They are also urged to use this department to air their own problems. A letter to the Executive Forum Editor is all that is needed.

Discussion

Selecting Shop Executives

It sounds a bit inconsistent in these days of so much specialized education and training to be advised to seek among the inexperienced in a particular line when looking for shop executives. However, experience alone has never made good shop executives and should not be depended upon for results, important as it is. A successful shop executive must be one who is ever on the lookout for improvements at every stage and in every direction. He must be of a studious disposition, and open minded enough to recognize an improvement, regardless of where it comes from.

—JOHN MARK MAY.

Psychology tests are a much over-rated method of selection, particularly as they antagonize the high-caliber applicant, and cause him to give a false impression of his ability. I would prefer to judge a man by learning something about his method of living, his attitude toward his work, and affairs in general rather than to rely on a psychology test and a statement of experience. No matter how good the experience, extravagant personal habits and a cynical attitude towards life in general, including one's job, will surely mark a man as one who cannot command the respect or confidence of his subordinates.

Experience along the specific line of the prospective employer is usually neither necessary nor entirely desirable. Experience with products having similar characteristics, however, is advisable. Each industry has kinks of its own which can be transferred to another to advantage. Herein lies the advantage of drawing executives from the outside. Such an executive is not tied down by traditions, which to many lines are a serious handicap. —DOUGLAS L. PARKHURST.

How Much to Invest in Fixtures

The subject of fixtures resolves itself into two questions: Are the fixtures for a new machine that has never been on the market; or are the fixtures for an old machine that has been redesigned? No fixtures should be designed for either class until a sample machine has been developed to the point where it is capable of turning out the accurate and satisfactory work for which it was intended. If this sample machine does not work out satisfactorily, another machine should be made, still without fixtures, in order to iron out all of the difficulties that arose in the first machine.

After the first new machine has passed the test, it is wise to make temporary fixtures until it is proved by satisfied customers that the new machine is going to be a success. If the new machine proves to be an experiment only, a conservative amount would have been expended on temporary fixtures.

Likewise in the case of the redesigned machine, permanent fixtures should be purchased only after the sample machine has worked out satisfactorily. Of course, there would not be the same gamble as with a new machine, because the experience gained in manufacturing the previous design would be available. The important question, therefore, when deciding "How much to invest in fixtures," is, "Is your machine a new machine on the market, or a re-design of a previous good seller?" The answer is all important.

—H. EZRA EBERHARDT.

Mr. Matthews would never consider going to an old customer for an advance order on the strength of his designs. The customer would consider that his orders were dependent upon the actual operation of the machine as built. Yet this customer is equipped to consider the plans of the proposed machine from an expert viewpoint, while the banker, from whom he proposes to borrow the money for tools and fixtures, has no intimate knowledge of the functioning of the new machine. The customer's reluctance would be accepted as reasonable and logical—why not the banker's?

Many a potentially good machine is ruined by a too confident attitude at its inception. Refinement of detail often makes the difference between a good and a bad machine. This refinement usually comes as the result of tests and the experiences of actual construction, as well as those of actual operation in the purchaser's shop. The machine that is all tooled up in advance, especially on borrowed money, has a hard road to travel. Changes effect tools and fixtures, but as there is no further money available unless more borrowing is attempted, the tendency would be to let it stay as is for awhile, until production profits release additional capital. However, since the machine is not 100 per cent right, sales are affected adversely, the tools and fixtures necessary for improvements do not materialize, and the venture ends in failure.

If, however, temporary tools and fixtures are used, the bugs can be gradually worked out of the machine by changing or replacing the tools and fixtures as needed, until the machine is in first-class shape. Then, if continued sales warrant it, permanent tools and fixtures may be purchased with every assurance of success. If sales do not develop, the investment in the temporary

fixtures is but a fraction of that in the permanent ones, and the loss is correspondingly less.

—Augustus S. Gwiro.

Royalties to Company Officials

There was a time when employment of a man was construed as a prior right to any ideas he might have while under contract. Fortunately for the good of both the individual and the company, this attitude is changing. Regardless of the law, a common-sense attitude is being taken. If it cannot be unquestionably established that the idea was evolved on company time, some method of payment is justified. A percentage of net profit seems to be the most equitable solution, despite its bookkeeping difficulties. Thinking beyond the requirements of the immediate job must be encouraged. The neglect of regular duties in favor of new ideas is a supervision problem, and should not enter into the discussion directly.

—John S. Moran.

In every industrial concern, there are one or more persons employed for the purpose of bettering the product. These persons may be a part of the experimental department, engineering department, or general executive staff. When these men have new ideas, there is no reason why they should request royalties for that which is expected of them. If they were to fall down in their work of improvement, it would not be long before the sales dropped, and they would most likely find themselves without employment.

There is another large field where our industries could obtain ideas for the improvement of the various products, and that is among the general workers. One of the greatest mistakes a large number of our industries make is the demand for the signature of every worker to a contract which gives the company the right to any invention the worker may have, and for which a payment of $1 is made. Many people become rich through the use of inventions which aid mankind. Therefore, a person employed for general purposes should receive proper remuneration for inventions of new products which increase the sales of the company with whom they are employed.

—Fred Aug. Schmidt.

Too Much Inspection

The majority of manufacturers hire inspectors and put them to work inspecting products which they do not know anything about. It is better to put these men in a sort of school and show them the assembly and how it works. In this way a lot of unnecessary inspection and arguments connected with inspection could be avoided.

Mr. Holland is right when he says that an inspector should prevent work from being spoiled, and should pass on work that will perform satisfactorily. Where tools and fixtures are so made as to produce interchangeability, 100 per cent inspection is not necessary. However, the foreman should check over the tools before they are turned in at the end of a job. This practice will catch any deficiency, such as misalignment in the tool.

—F. Klingenstein.

Paying Express Charges on Replacements

Looking at this question from a shop point of view, we can classify replacements in two classes; replacements due to defective material, and replacements due to poor workmanship or poor design.

In the case of a replacement because of defective material, the customer should pay express charges both ways. The maker has no way of telling whether the material was defective. He loses the whole cost of the part, and the least the customer can do is to pay the express charges. This method is standard practice in the automobile industry. In the case of faulty workmanship or poor design, the blame rests on the maker. He should stand the expense.

—R. Beaver.

Training Men for Different Jobs

The idea of training men for different jobs should be encouraged. It would create opportunities to determine the willing workers who readily adapt themselves to all types of the work, and who, because of their alertness and ability to learn quickly, form ideal types to fill vacancies as the occur.

The management viewpoint has been that the longer a man stays in a particular job the more expert he becomes, and consequently the more valuable. Looked at from another angle, however, when a man is too long on the same job the work becomes monotonous, and the man eventually becomes stale in spite of any wage incentives that he may have. Some men, it is true, prefer routine. They are usually the less ambitious sort. Most men who possess the average amount of ambition would be more interested and better satisfied if they were given the opportunity to tackle a number of jobs.

The man who possesses the ability and inclination to perform several jobs increases his usefulness in several ways. In dull times he is kept at work in preference to the one-job man; when opportunties for advancement occur he is most likely to be considered; and, since his services are more valuable, it is common practice in many companies to pay men of this type an extra hourly rate commensurate with the number of types of work that they can handle well.

The gains to management are equally great. It tends to smooth out the productive capacity of a plant in that the all-around men can take the place of absentees in case of emergency. Furthermore, it creates an abundance of competent workers who are readily able to handle orders in times of unusual activity.

—J. Kollarik.

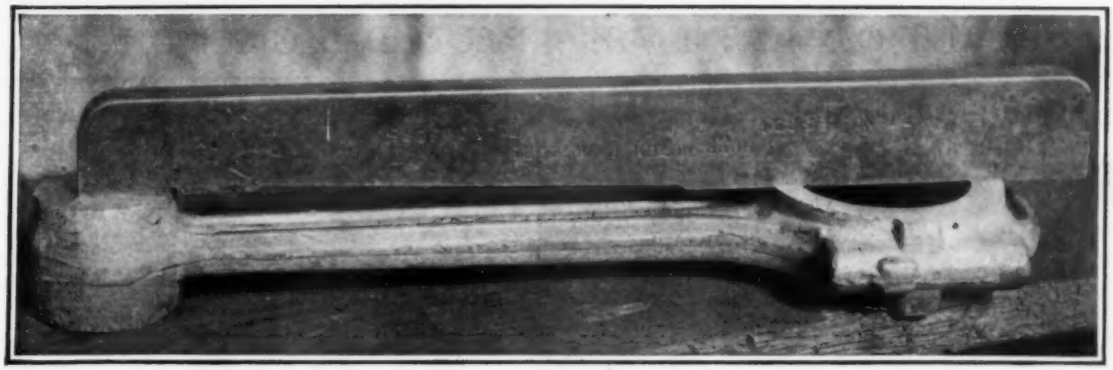


Fig. 47—Flat-bar gage for checking length of both bearings

Inspection Methods and Their Application

By Fred H. Colvin
Editor, American Machinist

To allow for a uniform thickness of the oil film on crankpin bearings, many automotive plants inspect connecting rods with a view to selective assembly

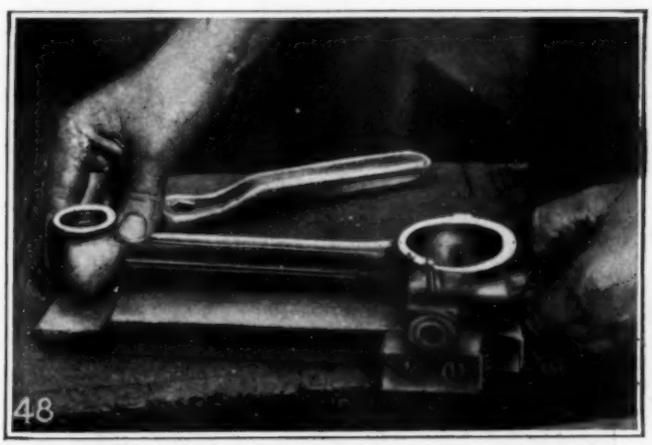
CONNECTING-ROD inspection in the Hupp plant begins after the rough milling of the sides. A flat bar gage is used as in Fig. 47, to see that the proper relation between the sides of the two bosses is maintained. Any variation is shown by a lack of parallelism that shows light under the gage at each end.

After rough boring, the rod is checked on the gage in Fig. 48 which tests the position of the locating point on the side of the bolt boss. The flush pin gage at the side shows the depth of the milled spot. A test of the rough boring itself is shown in Fig. 49, in which the gage checks the center distance as well as the diameters of the holes made by the two roughing drills.

After drilling the bolt holes and cutting off the cap, the size of the holes is checked by plugs, and the center distance of the holes is tested by the double pin gage shown in Fig. 50 with the cap in place. These inspections insure that the connecting rod bolts will fit in place without delay at assembly. The relative position of the mating surface for the cap is checked by means of the half plug at the large end of the rod.

The small end of the rod is then bushed and the large

The fifth article of a series. The sixth will appear in an early issue.



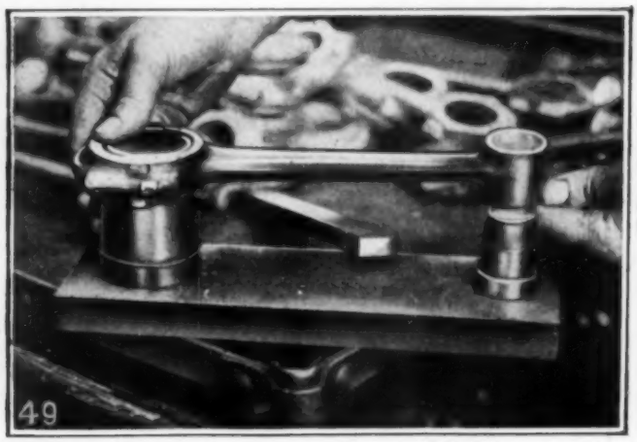


Fig. 48—Checking the size and position of the locating points on the large end of the connecting rod. The flush-pin gage shows the depth of the cut. Fig. 49—Testing center distance between the two holes after finish reaming. The gage is simply a base having two pins or studs of the proper diameter and center distance

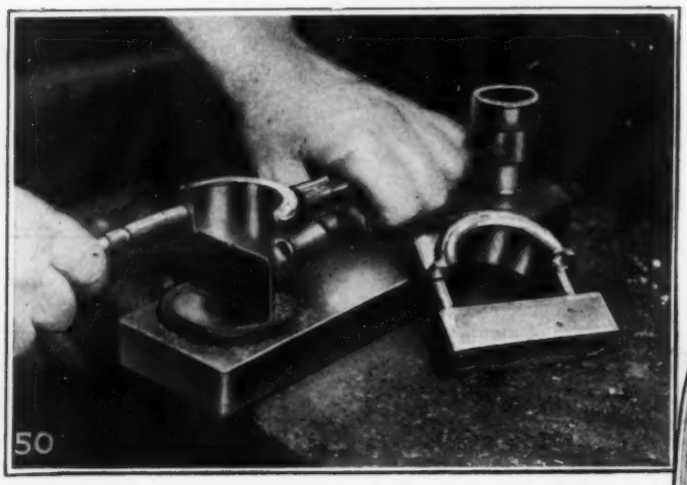


Fig. 50—Fixture for checking the mating surface of the rod with that of the cap. The bolt holes in the rod and the cap are tested both for diameter and center distance, using the gage shown in the cap

Fig. 52—Plug gages for checking the diameters of the bearings. The rods are sorted into groups according to the diameters of their bearings. They are then weighed as shown in the next picture

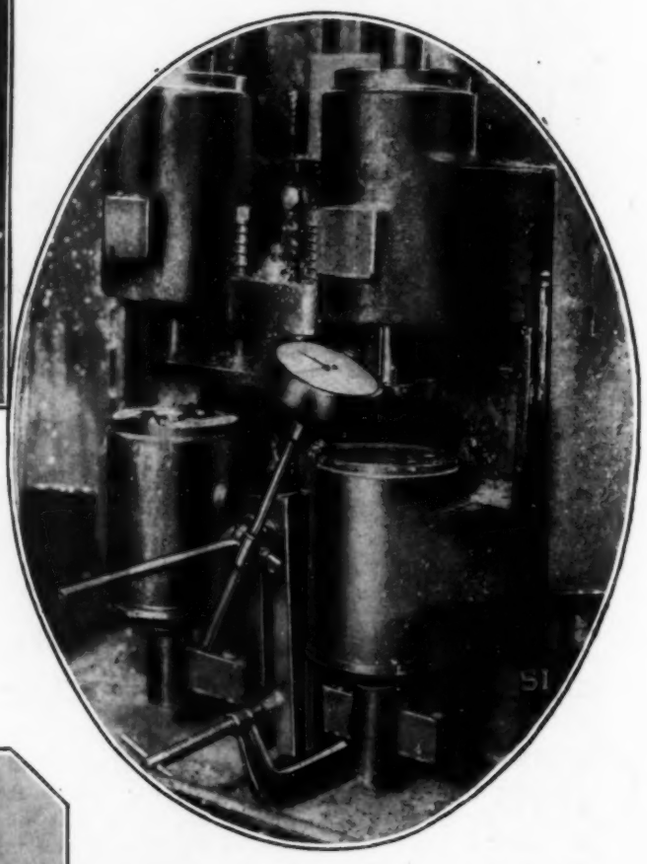
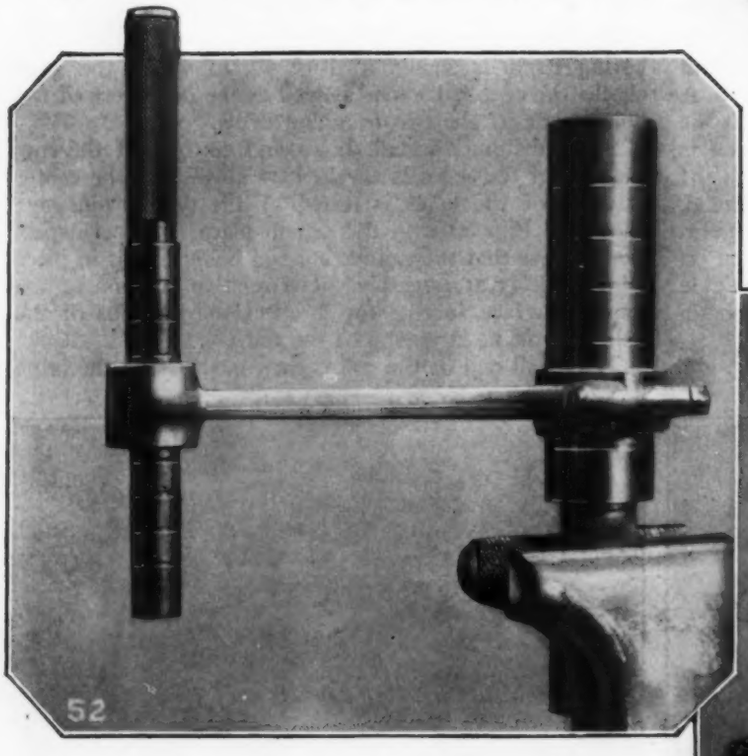


Fig. 51—Special head for diamond boring both ends of the rod at one setting. Spindles are being tested to insure correct alignment



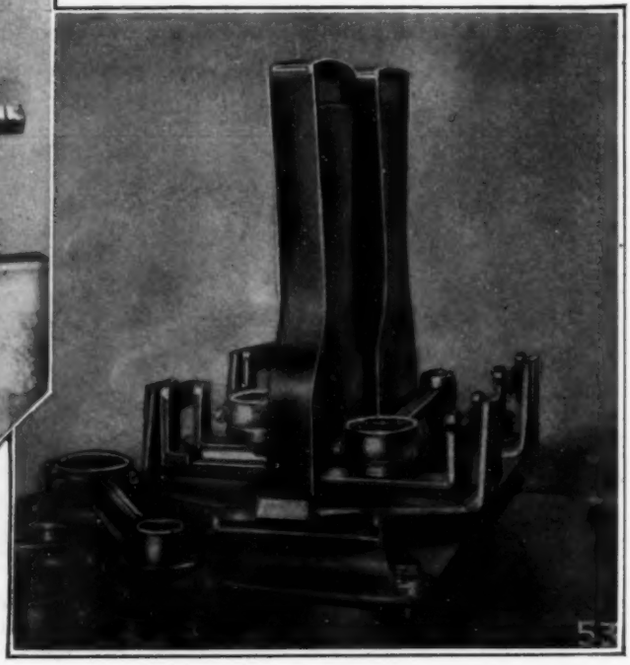


Fig. 53 — Two scales fitted for weighing connecting rods both for total weight and for the weight of the large end. This method enables the selection of rods into very carefully matched sets

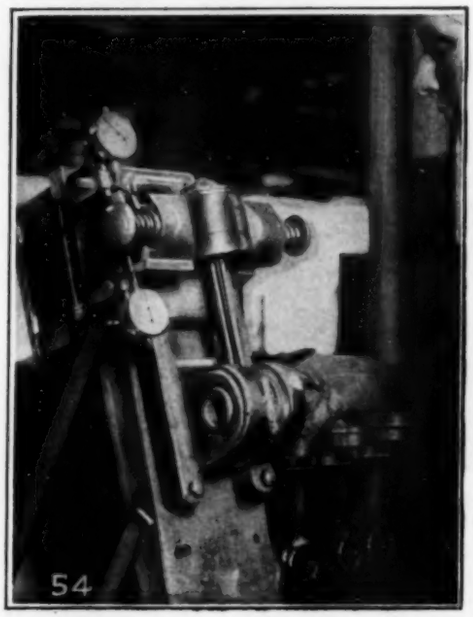


Fig. 54—Final checking of the squareness of the piston and rod after assembly. The two gages, through feelers and bell cranks, check the piston at two points

Fig. 55—Simple combination gage used by Chrysler to check the length of the bearing and its diameter at one operation. Both gages give go-and-no-go limits

Fig. 56 — A gage for checking alignment of the two holes in the rod. The rod is quickly held by the C-clamp, and two equalizing levers show alignment on two gages

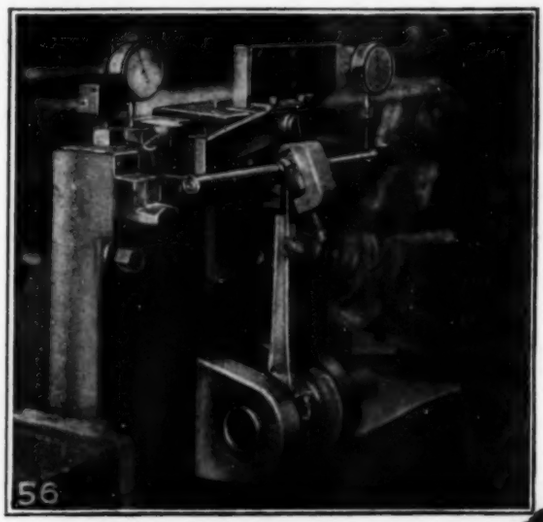
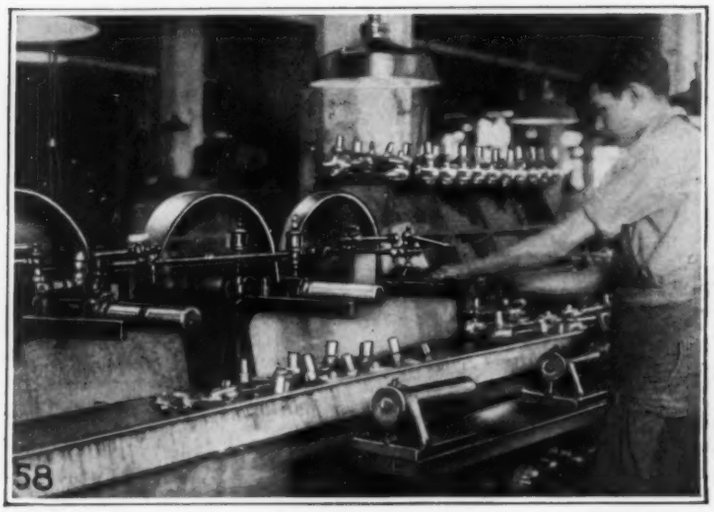


Fig. 57 — Reaming the small ends of rods in the Continental plant. After this operation the piston pins are put in and the rods go to the next reaming operation. The pins stay with the rods until they are assembled to the pistons



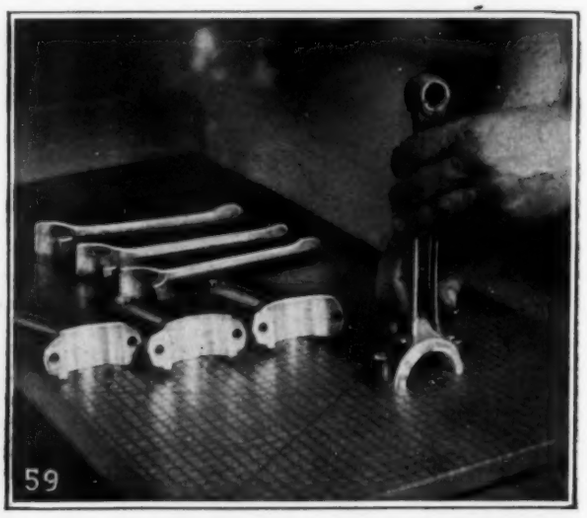


Fig. 58 — On this reaming machine, the large ends of the rods are finished. The plug gages in front enable the operator to sort the rods after he reams them. Fig. 59 — Testing the flatness of the mating surface between the cap and the rod on a checkered surface or lapping plate. This is employed in the Graham-Paige plant

end is babbitted, after which both ends are finish bored in a special machine carrying boring bars fitted with diamond cutting points. The head of this machine and the two bars are shown in Fig. 51. The bearings for the spindles are carried in the massive castings that also support the rods during the boring.

After boring, both ends of the rod are gaged by the stepped plugs in Fig. 52. The rods are then sorted into three sizes for the large end and three for the small end and are sent to be weighed as in Fig. 53. Here two scales are rigged up together so as to weigh both ends of the rods. The rods are then sorted into sets by weight and also in relation to the fits on the crankpins. It is the aim to keep the oil-film space constant on all crankpins.

As a final check before assembly, each connecting rod with its piston in place, is tested in the fixture shown in Fig. 54. The gages indicate any out-of-squareness between the sides of the piston and the crankshaft bearing. Contact pins go through the side heads of the fixture and actuate the gages through bell cranks, testing the piston at both ends. By swinging the rod forward it can be straightened or twisted in the usual manner, should the indicators show correction to be necessary. It is, however, seldom necessary to correct rods at this point, owing to the accuracy secured by the diamond boring machine. The testing fixture is substantially designed and built and is mounted on a bench at a convenient height.

In addition to other inspection tests, the Chrysler plant has two gages of particular interest. One, Fig. 55, combines two go-and-no-go gages for the large end of the connecting rod. The gage being used is a fixed snap gage for the length of the large-end bearing, while the crankpin bore of the rod is checked by the plug gage at the right. The gage for length of bearing consists of a base plate with the gaging arm held in place by the strap and bolts. The plug gage is simply strapped to an angle plate and is placed conveniently near the first gage.

The alignment testing fixture, Fig. 56, is also of interest. The long test rod is held by a C-clamp over the small end of the rod. The small fingers just below the

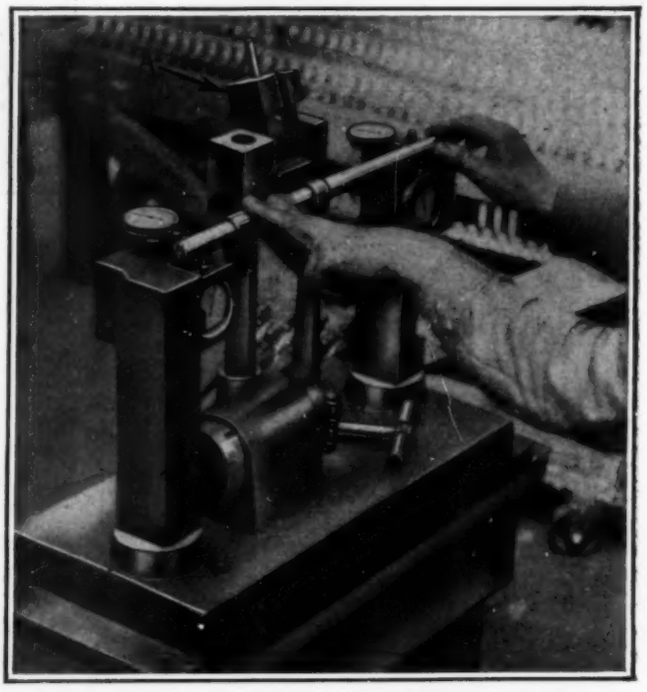


Fig. 60 — Another fixture for testing alignment of both holes in connecting rods. It locates both ends and the four gages show alignment in both directions

small end, tell if the rod is bent sidewise, and the long arm that bears at the ends of the test bars shows the parallelism in a vertical plane. There is also a similar floating lever in a horizontal position behind the test bar, which acts through a bellcrank on the gage at the left. These two levers and gages combine both tests in a single unit, and enable rods to be tested quite rapidly.

The Continental Motors Company inspects connecting rods after they have been given the final reaming. The reaming is done with reamers held in horizontal spindles, the usual, multi-blade reamers being used for the small ends as in Fig. 57, and the single blade reamers for the

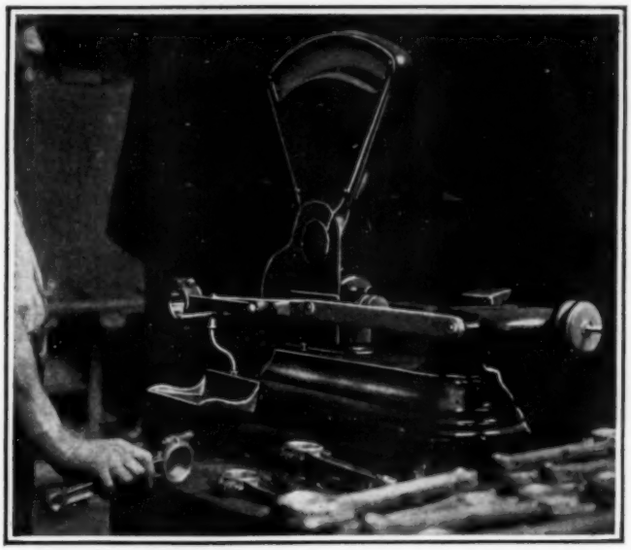


Fig. 61 — Weighing large end of rod on another type of scale. Rods are sorted for both total weight and large end weight, so that a set of rods will be uniform

large ends, Fig. 58. The machine equipment is simple but effective. Pilots on the reamers aid in maintaining good alignment, being particularly noticeable in the case of the large, single-blade reamers. Plug gages, having several steps, are conveniently placed in front of the operator and enable him to gage each rod as it is reamed and to sort it in its proper place, according to size.

Between the two reaming machines is the piston-pin storage bin. Here piston pins varying by small increments are placed in proper sequence and are selected to fit the holes in the small ends of the rods. The pins selected stay with the rods until they reach the subassembly where the pistons are added to the other units.

In the Graham-Paige plant, the usual tests are made as have been outlined. The bearings are diamond bored, a tolerance of from 0.001 to 0.003 being allowed for the oil film. Care is taken to have the mating surfaces of the rod and cap show a good bearing. The bearing is checked on the lapping plate in Fig. 59, the mating surfaces having been ground after the cap has been separated from the rod.

The fixture for testing squareness is shown in Fig. 60. Here the rod fits over the end of a plug that is supported in a particularly large bearing, and it will be noted that the test bar is unusually long. When the block *A* is swung down, its pin checks the position of the small end, and four dial gages show the alignment.

The scale shown in Fig. 61 is rigged for weighing the large end of the rod. The rods are first sorted by total weight and then reweighed and sorted by the weights of the heavy ends. In other words, rods of a given weight are reweighed for the large ends and re-sorted into sets of six, each one having not only the same total weight, but also the same center of gravity.

The foreman may be the key man in industry but the management must provide the right combination before he can unlock the door to production at a profit.

Tremendous Trifles in the Metal Stamping Business

By Robert I. Miner
Consulting Engineer, The Youngstown Pressed Steel Company

Starting from a Scratch

"THERE'S something stirring in that boy's noodle all right," observed Bill, the tool engineer, to Jerry, his right hand man. "Pink is a bright boy, and learning fast, and when you see him streaking for the tool room, rounding the corners on two wheels, you can bet something's up."

"Pink" reappeared with his friend Carl, the toolroom foreman. The two spent some time at Pink's board, looking over the tracings, Carl absorbed and thoughtful, while Pink's pencil sketched and indicated, each gesture accompanied by a searching gaze into Carl's face to see if the point had registered. Finally, Carl vented an inherent scorn for all unworkable engineering instructions and hooked a brawny arm in the direction of Jerry and Bill, who, with knowing winks, started for Pink's corner.

"Whatta you fellows trying to slip over here?" demanded Carl. "Haven't you ever heard about such things as gaging points? You fellows can argue your heads off, but you can't take away gaging points without making a whale of a difference in parts like this! It looks perfectly simple to rub out a few lines on a drawing, put in a few more, and tell the customer what you will do for him; but let's go over some of these operations. The part is put through all the dies, including the final forming, before we start putting any fancy holes in it. See that L-shaped depression, the cluster of two slots and a hole, and the three holes $\frac{9}{16}$ in. in diameter? The relations between all of them are pretty close now, aren't they?

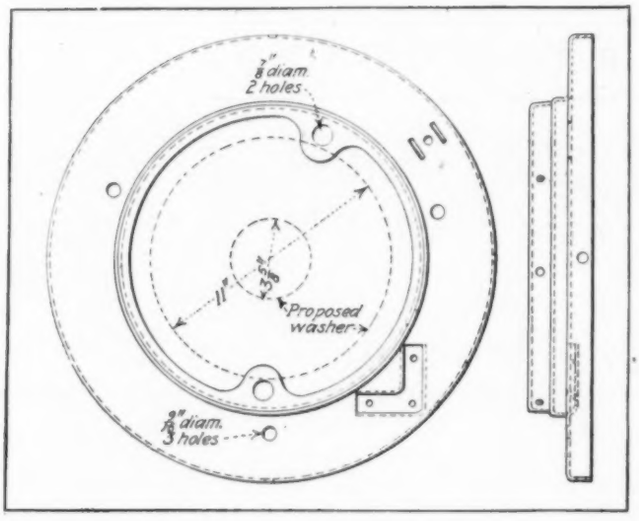
"In order to get these details in their proper locations, we've got to start from somewhere—and we can't start from a couple of scratches on the surface, either! Here's what we have been doing—we made the final form with the flange downward, and punched the two holes $\frac{7}{8}$ in. in diameter in this same operation. Well, these two holes were made the gaging points for locating all the rest of this stuff—now you calmly wipe 'em off the drawing!"

At this point Bill grabbed his phone and called for Art, the service manager. "Art, have you quoted the Direct Pump people on the ring they want made from the center of that flange assembly? What! Just mailed it? Boy, you'd better catch that letter, and come out here, before all of us get in a jam! Think you can, eh? Sure of it, are you? Fine!"

Art soon joined the group and, edging his way to the front, said, "Now what's the impossible thing that has to be done?"

Bill answered him. "It's just one of these fine ideas to save expense, Art, that looks perfectly O.K. so far as the part drawings go, but it sure raises heck with the press operations in this case."

"How come?" said Art, examining the drawings more closely. "Looks O.K. to me—the engineer at Direct



Pump changes his design so he don't need those two ears or the holes in 'em. He does want a ring of the same material, 11 in. in diameter, and a hole the same size, in the body. We know we have to make new punch and die rings, and machine off the lugs in the die shoe to drop the center punching. It don't add any operations, and we can use that center to produce the new ring, by flattening, using a 3⅝-in. stock die, and a couple of gage pins, can't we? The Direct people pay us for changing the tools—here's the estimate on the job."

"Hm," muttered Bill, "guess we'd better get our long-suffering estimator over here! Hey, Gary!" Gary had paid little attention to the gathering, believing the discussion to be the usual one about the best way to design some tool. He laid down his pencil, removed his green eye shade, and strolled over.

"What am I going to be hung for this time?" inquired Gary of the group.

"No hanging a 'tall," greeted Bill, as he rested a hand on Gary's shoulder; "its this change in Direct Pump's center flange, and the new part they want made out of the center. We can't find a point to gage from, without adding an extra operation, now that the two holes in the ears are gone. You know we used gage pins in those holes to locate the part in position to pierce those in the step, and also the holes in the rim—but you've probably seen something that we haven't."

Gary studied the situation just long enough to grasp it, then—"Guess its on me, fellows—got part of it, but I clean muffed the part about taking away the locating points! Got enough money in the estimate to change the shape of that center hole, but not enough to put back an essential that was removed—if we can put it back."

"Well," spoke up Art, "its all over now, except to write a new letter to the Direct people and maybe get permission to jack the price up a bit. Let me know how much, Gary," and he started away. "Wait a while, Art," said Bill, "we told the Direct people we could do this, without extra operations, didn't we, and gave them an estimate on what the expense would be for changing tools? You know how suggesting that the customer shall pay more money for the part is going to set with our high-pressure sales manager! Nope, we've got to find a way out. Listen, Gary and Carl are talking!"

"How would this be, Carl? You can't very well gage from those three bosses, or the L-shaped depression, with any hope that those holes in the step will be where they belong, but why can't we punch two small holes on the same centers as those which were removed? It means only new punches and new buttons."

"O.K," answered Carl, "but that means taking it up with the customer to see if he minds having them there,

We can't start from a couple of scratches, either!

and getting them all fussed up. Rather not do that if there's another way out."

Carl sketched quietly for a moment. "Here's what we'll do, Gary. See those four holes in the rim? They are put in on a horn press, one at a time, with an indexing fixture. While I don't like this method as well as the other, we can run that operation as the first piercing. Then, by making a snug-fitting gage-ring and using two pins on the second piercing, we can get the other holes in the top and step where they belong. There will be some extra expense, old timer, but I'll try to speed up and cut some corners so we cover on the tool estimate."

"Zowie!" gasped Jerry, as the gathering broke up, "ain't it the truth that every little change runs into other details like the roots of a tree, before you know it!"

Crankcase Inspection

Crankcase inspection—of a sort—is offered by most roadside service stations these days. That is, they will inspect what comes out with the old oil. But the real thing, inspection at the factory, is very different, and varies in almost every plant.

Next week, in the Automotive Inspection Series, there will be published the first installment of the section on crankcase inspection. No production man can afford to overlook any information on first-class inspection methods.

Observations on Swiss Shop Practice

By K. H. CONDIT
Editor, American Machinist

IN SWITZERLAND the inquiring visitor to industrial plants first meets the progressive reception. It varies in degree with the size of the plant, and the reason for its existence may lie in the fact that most of the product is exported. Thus the customers are in all parts of the world, speak all kinds of languages and must be properly received when they call on business.

Be that as it may the progressive reception is an impressive affair. One presents his card or letter of introduction to the doorman at the main entrance. If the doorman does not happen to speak his language he is asked to wait in the first waiting room until some one who does can be summoned. The purpose of the visit being explained, the visitor is ushered into the next reception room, which may be quite some distance away. Here he is quite likely to be asked to sign the visitor's book. This formality over he is conducted to a small conference room where the man he wants to see presently meets him and greets him in his own language. At this point I want to express my admiration for the ability of the Swiss to speak other languages than their own. Officially the country speaks three languages, German, French and Italian, and all notices must be printed in those three languages. The German Swiss element, much the largest in the country, employs a dialect that is so different from German that a German finds it difficult to understand. Each mountain valley has its own dialect variations. A few days amid such confusion of language should convert the most conservative to a belief in the desirability of an international language.

While waiting to see the managing director of one large corporation I heard him speak Holland Dutch to one group of visitors, German to another and German Swiss to my guide. The telephone rang and he conversed in French. Then he turned to me and talked for twenty minutes in almost perfect English. How many American executives could duplicate that feat?

The answer, of course, is that the Americans don't have to. They and their customers, with very few exceptions, speak the same language and can dispense with most of the formalities. If the day ever comes when the majority of American manufacturers make a determined bid for export business, then more attention to languages may be necessary.

It is hardly possible to generalize on the type of factory building in use. They vary greatly, each manufacturer apparently having followed his own ideas. This much can be said, however, that masonry and concrete are decidedly popular. Judging from the solidity of the construction there is little expectation of radical changes in conditions or requirements. One engineer commented somewhat bitterly on the fact that it cost so much to tear down the old buildings when expansion or rearrangement was needed that they often had to leave them up and carry on as best they could with the handicap of obsolete housing. Set amid trees and green fields, as these factories are, and almost always in view of the beautiful Swiss mountains, they seem almost ideally situated. One gets used to his surroundings, of course, but the visitor finds it somewhat difficult to divert his attention from snow-capped peaks and concentrate it on the uninspiring details of internal shop arrangement.

National policy in Switzerland calls for concentration on products that are new or different from those made in other countries. American machine tools are chosen where the requirements are accuracy or high production. Sixty to eighty per cent of the production is exported and most of the raw materials have to be imported. Hours of work are closely restricted by law

As to machine tool equipment the largest number of tools in use are of German make but it is flattering to be told by executives in such a country as Switzerland, which has only a very few machine tool builders, and has also a high reputation for the quality of its workmanship, that American tools are bought where the requirements for production or accuracy are severe. According to my observations, tools of that nature are for the most part American.

Progressive assembly of small products has brought with it a few belt conveyors. The heavier machines for which Switzerland has developed a respectable foreign market are not built in lots sufficiently large to justify such methods. As in most other European factories where heavy parts must be handled the Swiss plants are supplied with narrow-gage tracks down every main aisle, with turntables at the intersections. Some electric trucks are used, and the usual overhead cranes as a matter of course.

Gang set-ups are in evidence and there are plenty of ex-

cellent jigs and fixtures, some of them double or multiple.

A rather intimate discussion of national problems brought out the fact that the Swiss manufacturers plan to use their assets of highly skilled workmen, small but well-equipped plant and the consequent ease of taking up new products to make the new and different things that are not generally made in other countries. They believe that by so doing they can get the cream of the business before the slower moving industries of the larger industrial nations can get started.

With this laudable policy in effect it is somewhat surprising to find how few machines with individual motor drive are in use. It would be natural to expect that where new products are to be taken on quickly the equipment would have the maximum degree of flexibility. The newer American machine tools are of course motor driven but the great majority of the drives are by belt.

In many respects Switzerland is distinctly Socialistic. The hours of work per week are limited rigidly to 48. No manufacturer may ask his men to work more than this number of hours under ordinary conditions. In emergency it is permissible to extend the week to 52 hours for a certain proportion of the force, but only when it can be proved to the governmental authorities that failure to put in this extra time will result in the loss of a contract.

Another little item that has to be allowed for by the Swiss manufacturer is the annual period of military service required of men in the military classes during the summer time. The training lasts for four or five weeks and may draw out the whole working force of a factory department if they happen to be from the same canton.

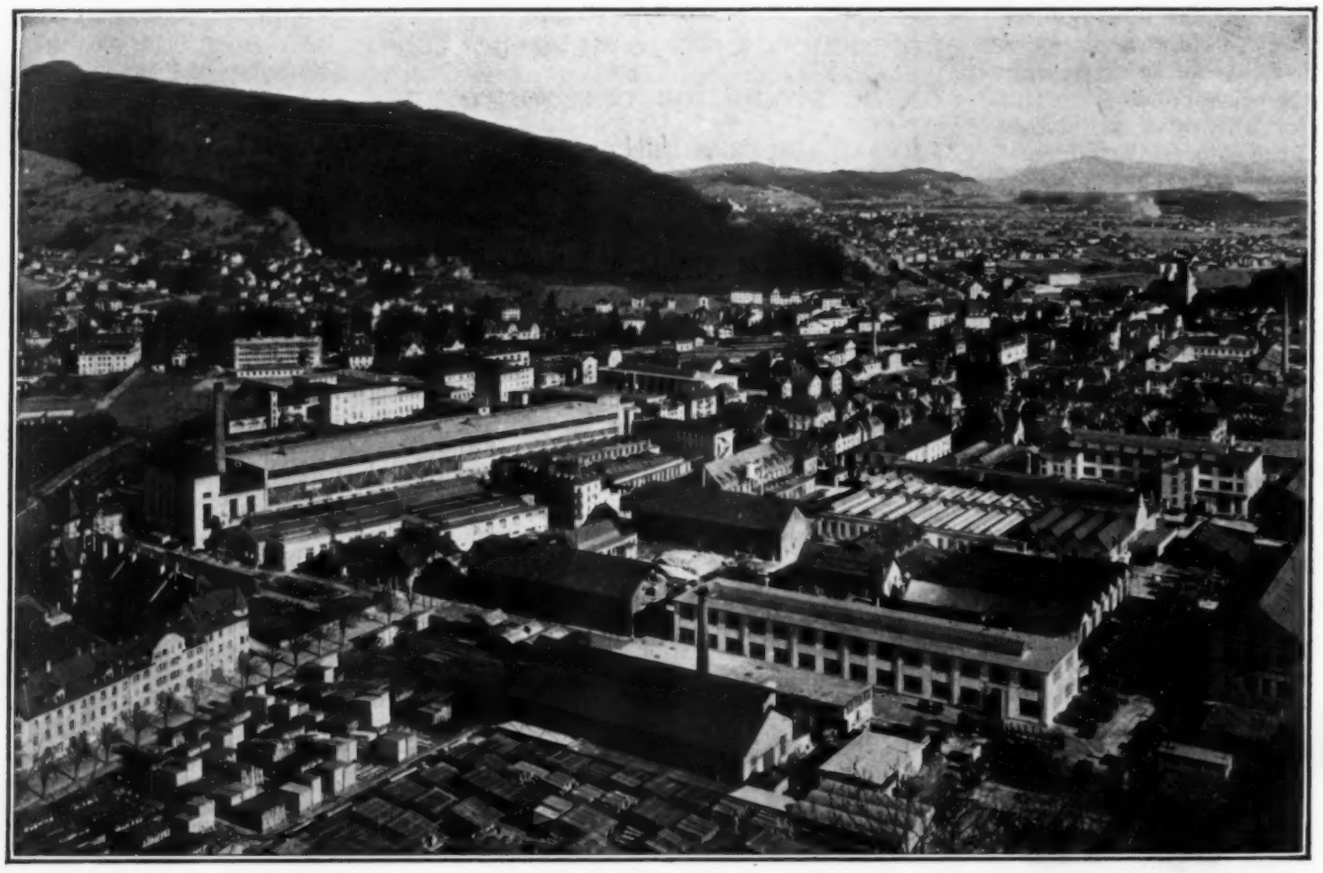
In the district around Zürich, where most of the large plants are situated, the workmen live on their own small farms and go back and forth to work on train, tram or bicycle. The French plan of a two-hour lunch interval is rather generally followed, many of the workers being able to get home and back during that time. In at least one instance it has been found necessary to provide bathing and eating facilities for the men living at a distance who want to clean up and eat at five o'clock.

What corresponds, to a certain extent, to foreman training in America, is carried on through the social clubs to which many of the men belong. They have their own lecturers and instructors, often from the technical schools, and it is therefore not considered to be one of the functions of the management to carry on any training activities, except, of course, for apprentice training which is well organized.

Switzerland produces practically none of her raw materials for the metal working industries. They must be imported and therefore carefully tested and inspected. Most of the factories have more than usually complete equipment for this work.

By the same token, the greater part of the factory output is exported, as mentioned before. In three of the largest plants the percentages of exported to total production were respectively 60, 75 and 80.

The Swiss engineers and production men are generally men of considerable foreign experience. So many of them have been to the United States, for instance, that they have organized a society known as the Swiss Friends of the U.S.A. Membership is limited to those who have resided for at least a short period in the United States. May the membership increase and the friendly spirit that prompted the founding of the organization gain in power.



Almost always in view of the beautiful Swiss mountains, the factories seem ideally situated

The following narrative is a "case" presentation of the topic. It has been written to involve some of the questions that arise in the average shop. For guidance in preparing discussion the questions at the foot of the page have been prepared

Reading the Shop Language

"AL, I'm beginning to think that *Mis* Fortune is the only friend I've got lately."

"What's the matter now, Ed?"

"Enough, all right, and just now I've had two batches of spoiled work because the operators couldn't read blueprints."

"Well, you don't leave it up to a production operator to interpret drawings, do you, Ed? They are not expected to be machinists, are they?"

"No, not entirely, Al. But I'm getting tired of this old idea that nobody but machinists are expected to read blueprints.

"You would'nt want anyone in your department who couldn't read English, would you? Well, aren't blueprints the language of the shop, and isn't it about time that everybody who works on important operations can read shop language? Al, I think it's up to someone to see that every man in the shop can read prints. Every once in a while something comes up that makes it necesary to leave a sketch with the machine operator, or he gets into a place where he ought to check up on a print. Then, if it's a little bit complicated the chances are that the average operator gets things backwards like my men did this week."

"I see you're wrought up, Ed. Go ahead and get it out of your system."

"Well, that's that, Al. It's all right for the automobile factory that has a big production, and can keep the same operator turning the same lever, every day, to have someone to interpret everything that comes up. But the average shop like ours has to meet a lot of emergencies, and I'm all for every machine operator being able to read blueprints, and not have a holy horror of them like many of our fellows do."

"There is something in the argument, all right, Ed. The personnel department sees to it that all apprentices get a course in blueprint reading and sketching. Possibly it ought to be extended so that every operator on the permanent staff would be given a compulsory short course in blueprint reading. Maybe you're right that it's language of the shop, and ought to be understood by everyone in the shop. Why not put it up to Williams that way?"

Are machine operators expected to read blueprints? Or should the foreman make everything plain to them? Is Al right that a short course in blueprint reading would settle the matter?

All foremen are urged to discuss these questions vital to their work; of course the

discussion is not limited to foremen. Letters accepted and published will be paid for

Discussion of Earlier Topics

Putting One Over on the Builder

THERE are two people who would be dishonest if a new part was expected without charge—the planer operator, and the foreman. Business today does not depend on such petty offenses to show a profit on the balance-sheet. Perhaps Ed was right in saying that many companies are guilty of this practice. However, it would be found that these companies are small, and possibly this is one reason why they are small. Parker would do well to forget these tricks. He would be a better man and save the company many more dollars by making the machines last their full lifetime.

—Roy E. Peterson.

CASES of this sort frequently occur on machines that were purchased years ago. Yet there is apparently no doubt in the user's mind but that he is entitled to repair and replacement service without charge. He feels that, since he paid a good price for the machine, he is entitled to full service throughout its lifetime. Machine users do not consider the cost that the builder bears in sending out high-grade mechanics in response to such service demands, nor what he pays for such replacement parts. If the hint is given that the customer will be expected to stand the charge, the customer intimates something about diverting future business into other channels. The builder decides to shoulder the expense and writes it off.

This situation could be remedied if the machine manufacturer would adopt a courageous policy in regard to the amount of free service that he will give, and make it clear that after a machine has been in use for a certain time, all service will be charged for.

—Harry Kaufman.

Wear Goggles or Quit

A RULE requiring the wearing of goggles when operating a grinding machine, has never been and probably never will be found 100 per cent enforceable, except in cases where the sole occupation of the operator is grinding. Even in such cases it has been found advisable to close the supervisory eye, as it is not logical to expect any man constantly to wear a pair of goggles which prevent the free circulation of air about the eyes, or which chafe or irritate the skin.

The use of goggles proves a hindrance rather than a benefit to a mechanic who occasionally grinds a small tool. First, the same pair of goggles will not fit each man comfortably. Second, it is practically impossible to keep the lenses clean at all times and an oily fingerprint on a lens may cause more accidents than the failure to use the goggles. Third, a humid atmosphere or a perspiring operator will steam the lenses as soon as they are placed, thus rendering their use impossible. Fourth, unless the frame of the goggles fits the face properly, openings will be left through which pieces of steel or emery may enter. A workman soon learns to squint his eyes so that his eyelashes afford practically the same protection as goggles.

The purpose of any rule should be to warn or instruct, never to threaten or intimidate. I have found that the best method is to point out the dangers, suggest the use of goggles and issue a statement to the effect that any workman, using the grinder without goggles, does so at his own risk. This will throw the men on their own, and result in greater care. —R. H. Kasper.

MEN are still being seriously injured for want of goggles. Therefore, to prevent innocent dependents in the community at large from becoming joint victims with the careless ones, something has to be done. So why not a drastic, clear cut rule, "Wear Goggles or Quit"?

For the man who deliberately refuses to obey the rule, the best enforcement is to apply the rule directly and immediately. For the man who has honestly forgotten in the rush of work which only occasionally takes him to the grinder, a single warning may be given. Not as a punishment, but to help to impress it on his mind, he may be invited to spend a few extra hours on the grinder without pay after the regular day's work. As an alternative to being fired, this is not any too drastic. If he's the right kind, he will see the point. —L. Butler.

MANY workmen will argue that they cannot see through goggles because the goggles get steamy, but this world looks a whole lot more beautiful through steamy goggles than through glass eyes. Furthermore, goggles are something which the employer furnishes to his men free of charge, and most of the benefit derived from their use is by the worker and his family. Every

THE · NEXT · TOPIC

Equipment and the Foreman's Reputation

ADVANCE QUESTION

Bill Jenks quits his job because the boss won't buy decent machine equipment. Ed thinks it's up to him to run whatever the boss provides. Al agrees with Bill. What do you think?

thinking man should appreciate this. This life of ours has plenty of hazy days without making it darker with glass eyes. This rule of wearing goggles could be enforced by notifying the men as they are hired that the company demands its men to wear goggles on certain kinds of work. Then the men could decide whether they are willing to wear goggles or go without the job.

—J. KARLIN.

PERHAPS one of the hardest things to contend with in manufacturing is to educate the worker to do things that are really for his own good. I hardly believe that any goggles have been invented that appeal to the employee. He sees them only as enemies to his earning capacity, which to him is all important.

That the shop loses nothing if he is injured is untrue. It not only loses the labor of a man who may be highly specialized or exceptionally skillful, but it pays for time lost for an injury that may incapacitate him, since compensation is almost universal. As the company must always strive to further the interests of the stockholders, the ruling of Williams is fair to both company and employee. It protects the money of the company, and the well being of the employee both for himself and for his dependents.

—F. G. WILSON.

A NORMAL-MINDED mechanic realizes the interrelationship of his acts to the life of others. He would not advocate the repeal of all license laws for automobile drivers or airplane pilots, or insist on the abolition of all traffic control in large cities just because it interfered with the careless do-as-you-please habit of certain individuals. Why should he, then, object to wearing goggles in a shop when grinding, and claim that his personal liberty is being infringed upon if he is told he must do so or quit? The only answer is that he is confused about personal liberty, and doesn't realize that the more of life's possessions he really has, the less he has of this kind of personal liberty. Firing him may arouse his latent mental processes, and even if it doesn't it will protect him and his dependents from the consequences of his own foolhardiness.

—JOHN F. HARDECKER.

Keeping a Machine Busy

FROM the foreman's and operator's point of view, it is always best to scrap a machine just as soon as it begins to wear, or just as soon as a better machine is placed on the market. If management should follow their suggestions in regard to scrapping old machinery, the firm would soon be bankrupt. There are other factors beside time saving to be considered.

Savings effected by the use of a new machine must not only pay for the new machine, but also pay the interest on the investment and the value of the old machine at the time it was discarded. Another thing to be considered is the equipment in other departments.

—WM. J. OWENS.

He Never Asks for a Raise

WHEN a man applies for a job to another firm he is free to bargain, and loses nothing if no agreement is reached. If he has to ask for a raise in his present job, he will naturally choose a time for making the application when he is least likely to be refused, that is, when there is a rush of work or when he would be most difficult to replace. This method approaches a threat. Getting an increase under such circumstances does not give him the satisfaction or feeling of security which will be his when receiving a voluntary acknowledgment.

The Hankins type of man does not want to use threats, neither does he want to appear dissatisfied. For this reason he will not risk being refused a request for a raise, but will leave.

—A. F. GUYLER, *England*.

Vacations as a Bonus

SOME firms make a practice of paying their foremen and responsible shop hands for their holidays. Where this is not the practice, the vacation bonus system should be introduced whereby a foreman or other responsible hand will receive vacation with pay according to the output of his department. The management should calculate the output of each department, the amount of spoiled work which cannot be avoided, and each foreman should be shown the management's requirements for his department. Every foreman who runs his department at, or better than the management's requirements should receive, say, a two weeks' vacation with pay. If the department fails to come up to the requirements, then the foreman should lose part of his vacation. The other shop hands should receive a percentage of their pay during vacation for good behavior, punctuality, and freedom from spoiled work, factors which are largely unrewarded under the usual bonus system.

—W. E. WARNER, *England*.

Standards for Machine Finishes

SOME years ago I used the following system. I replaced the finish marks on all drawings with the notes "finish A," "finish B," or "finish C." This told the machinist that I wanted a smooth, accurate job for finish A; one within 0.008 in. plus or minus, and about $\frac{1}{32}$-in. feed for finish B; and a rough finish to caliper or scale for finish C. One of the boys called this last finish "washboard" finish.

Such notes on the drawing, together with a set of standard, samples of finishes would result in a marked saving in any machine shop. Also, the life of the foreman would be much easier as he would not have to tell the men what finishes to use.

—ROBERT MAWSON.

Helping the Efficiency Engineer

THE foreman holds the key position in his department. His attitude will always be reflected by the workers under him. Therefore, if he maintains a neutral attitude, or fails to co-operate with the efficiency engineer, it will be difficult to enlist the co-operation of those under him. The foreman is in a position to make recommendations as to the employees on whom the first study should be taken. It is usually the case that where the engineers and foremen are in close harmony, the shop is forging ahead.

—JOHN KOLLARIK.

Reinforcing Craneways *in a Big Shop*

How new columns were placed to support the runway for a new 130-ton crane, while leaving the old columns to carry the roof trusses as before

REINFORCING crane runways so as to carry loads made necessary by the increasing size of the machinery that must be handled, is a problem that many concerns face sooner or later. In some cases it may be necessary to tear down the old shop and rebuild, but in the case of building No. 49 at the Schenectady plant of the General Electric Company, the building was in excellent condition and a plan was worked out that has proved very satisfactory.

The building itself answered all requirements, but it became necessary to increase the crane capacity to considerably more than double that of the original design. Furthermore, the location of some of the heaviest machines made it impossible to put in additional columns at all points, so that it became necessary in one or two instances to use long spans and very heavy girders. As originally built, the roof trusses and the craneway were supported by columns on 40-ft. centers. This made it possible to put in entirely new and much heavier columns between the old ones in most places, and yet maintain 20-ft. centers between the old and new, so as not to interfere seriously with the movement of material in the shop. In a few instances the location of some of the largest machine tools made it impossible to put in these intermediate columns, and here it was necessary to support the new craneway on columns 80 ft. center to center, and to use a correspondingly heavier girder in the craneway itself.

As the condition of the ground where this building is located is not well adapted for carrying heavy loads, it was necessary to exercise extreme care in determining upon the new foundations, and in designing and constructing them to carry the desired load. So, in addition to erecting the new columns, it was also found necessary to strengthen some of those already in position, and the method by which this was done is of particular interest. The accompanying illustrations show some of the reinforcements which, in nearly every case, were made by welding on reinforcing plates by means of the electric arc.

One of the problems was to avoid disturbing the 36-in. concrete base which supports the large, cast-iron floor plate that has played such a part in developing the use of heavy, portable machine tools in large generator work. This floor plate has become famous as one of the first to be used where heavy machine tools were taken to the work. Yet the demands for crane loads of 130 tons made it necessary to provide new crane-runway supports, although it was found possible to use some of the old runway girders after they were properly reinforced.

The plan, as worked out by the engineer of the American Bridge Company, who designed the reinforcements,

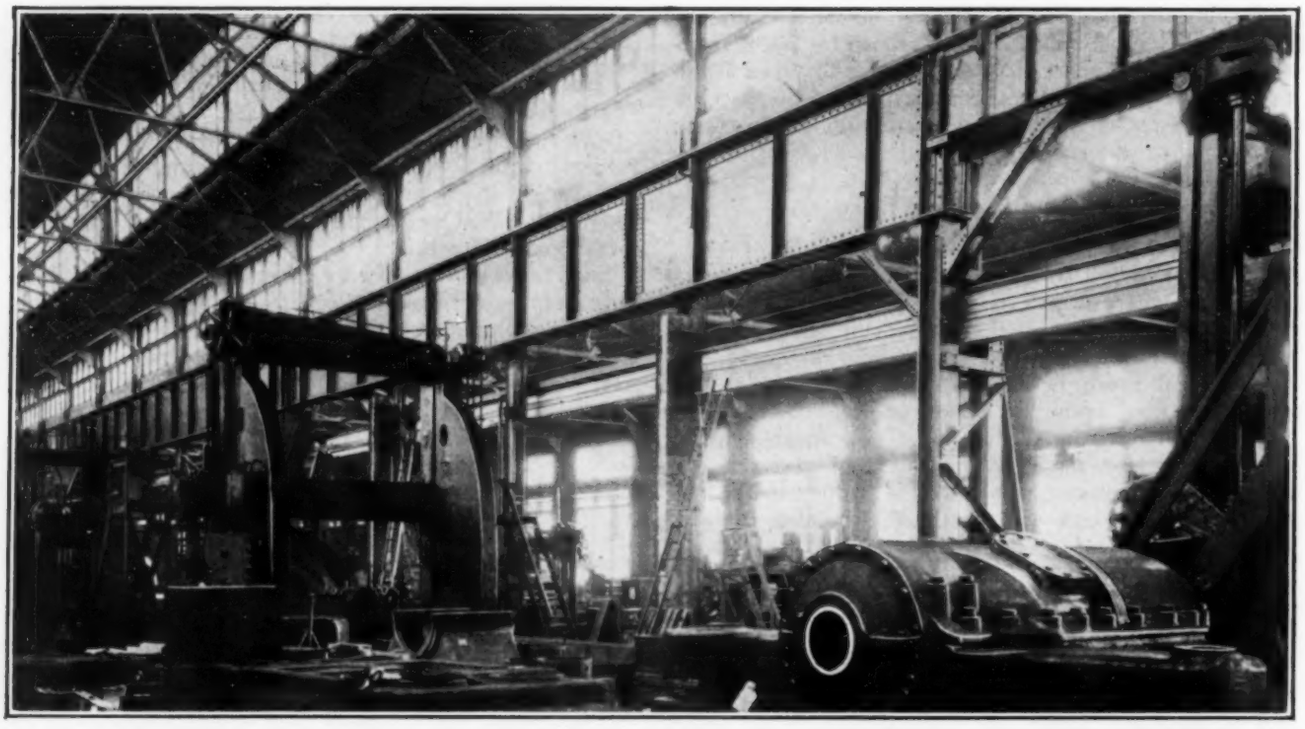


Fig. 1 — The new, heavy girders in place on the two 80-ft. spans. These long spans were made necessary by the inability to put in new intermediate foundations, owing to interference with large machine tools already installed

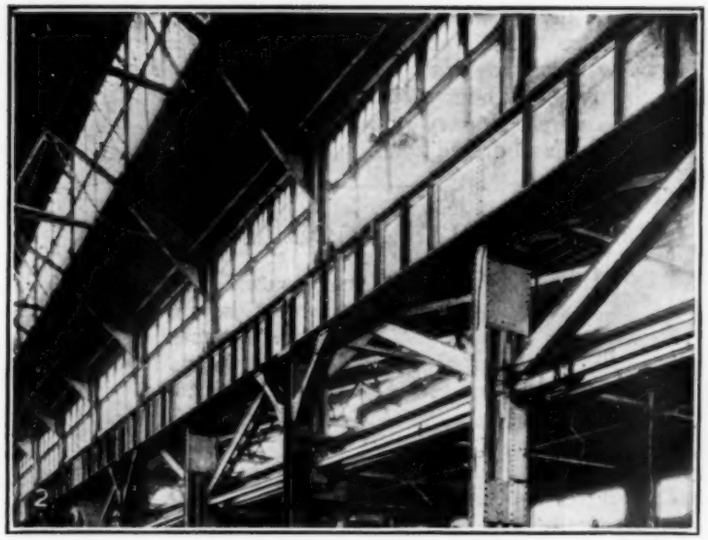


Fig. 2—The new intermediate columns in place to support the crane girder. This view shows parts of the old columns cut off below the crane runway, leaving the balance to support the roof trusses.

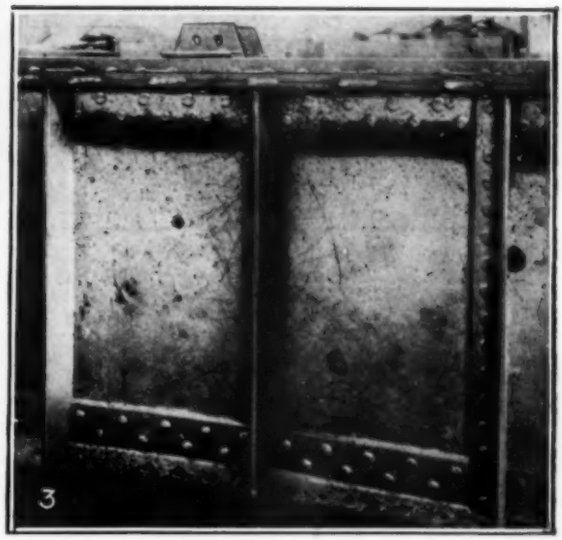


Fig. 3—A portion of the old girder that has been strengthened by the 2x15-in. plate on top, and the reinforcing ribs welded to the sides

was to leave the old columns to carry the roof trusses but to relieve them of all crane loads. The old columns, however, were still used to add side stiffness to the new crane girders. But rigid connections could not be made, as the crane girders must be left free to deflect without throwing the vertical load on the old columns. This necessitated a series of slip connections to give the desired side stiffness to the girders, and yet leave them free to move vertically under the crane load. A general idea of the method employed can be had from Fig. 1, which shows the heavy girders, 80 ft. long and with a center web of $\frac{7}{8}$-in. plate, 86 in. deep. The top and bottom flanges of the girders are each made up of two angles, 8x8x1 in., and three coverplates 24x1 in. The old columns were built up of Z-bars and were double, one-half coming under the crane runway and the other half extending upward to support the roof. As will be seen, the parts that formerly supported the crane runway have been cut away below the heavy girder, leaving the other parts to support the roof. Both parts of the old columns have, however, been tied together by a continuous reinforcing plate welded on each side, so as to add greatly to their stiffness. This view also shows the channel- and plate-steel brackets that support the crane runway in the side bay. The brackets were welded to the columns by the General Electric Company, and are good examples of how the severe twisting stress from the load on the crane was successfully taken care of by welding. Where the new columns are 40 ft. on centers, they carry the crane in the side bay as well as the 130-ton crane, so that the continuous reinforcing plate was not required on the old columns coming at the center of the new 40-ft. spans. The construction of the new columns at the end of the girder can be plainly seen.

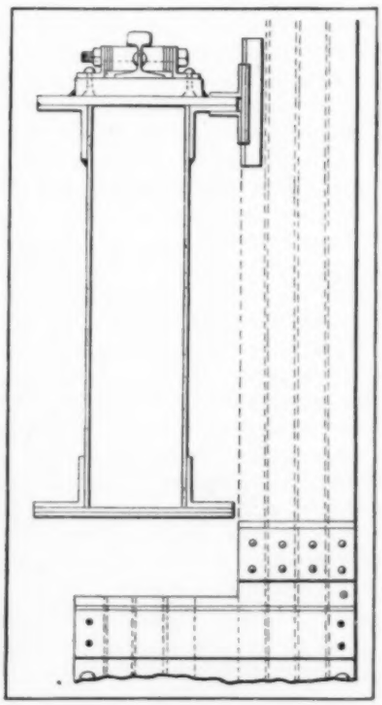


Fig. 4—Detail of the crane girder showing how it is independent of the old columns for support but is tied to them at the top for side stiffness. The method used in anchoring the rail packing-strips, allowing side alignment also is shown

It was also found that by strengthening the old girders, they could be used in parts of the new runway, as in Fig. 2. These girders have two webs 48 in. deep, separated 11 in., and have been reinforced by plates on top to form the rail seat. The plates are 2x15 in., just fitting between the rivet heads. In addition, stiffening bars were welded half way between the angles that were riveted in place when girders were built. These bars are to be seen in Fig. 2, and more in detail in Fig. 3, which also shows the 2-in. plate on top welded between the rivet heads. It will be noted that the riveting between the top plate and the side angles has been reinforced by welding. On top of the 2-in. plate are ears made of angles riveted to the top stiffening plates; they are for anchoring the crane rail. They are shown in detail in Fig. 4, which also shows the con-

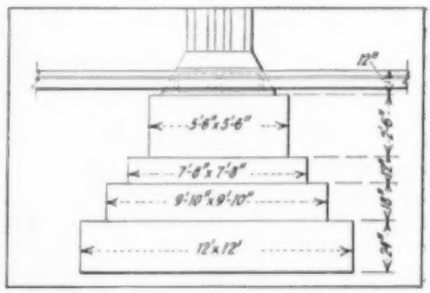


Fig. 5—One of the original foundations under the old columns. It did not seem advisable to attempt to increase these foundations, owing to the nature of the ground, so new ones were put in, half way between the old, of the type shown in the succeeding illustration

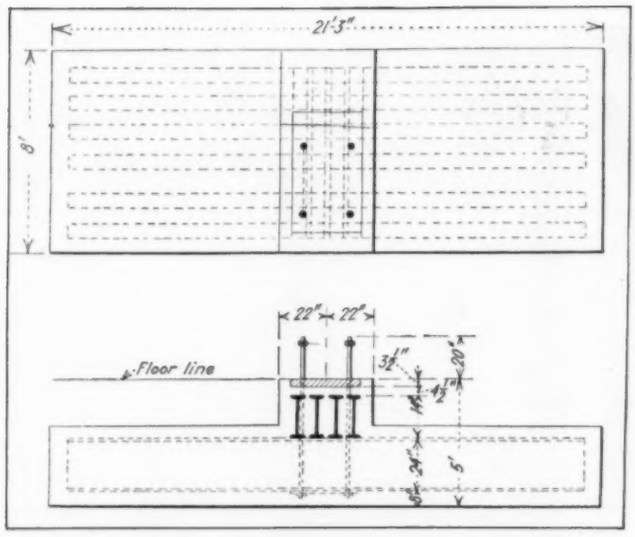


Fig. 6—The foundations for the new and heavier columns. The lower slab is 38 in. thick and the upper cross-piece 22 in. The reinforcements are six 24-in. I-beams in the lower slab and four 20-in. in the upper cross-piece

nection at the side of one of the old columns, and the clearance at the bottom.

The nature of the ground made it inadvisable to enlarge the original column foundations, one of which is shown in Fig. 5. Instead, it was deemed better to leave them alone and to put in new foundations and new columns as previously stated. The new foundations are of entirely different design from the original ones. Fig. 6 shows one of those used for the majority of the new columns. The foundations for the columns supporting the long 80-ft. spans of the heavy girder are 14 ft. wide instead of 8 ft., but of the same general construction. The reinforcements are six 24-in. I-beams running lengthwise in the bottom slab and four 20-in. I-beams laid crosswise in the upper slab.

Tolerances on Drilled Holes

By Chas. F. Henry

THERE is some discussion going on as to setting tolerances for drilled holes. Some feel that it is very important, while others think that present practice takes care of the situation.

The size of drilled holes depends on both the diameter of the drill and the way in which it is ground. Every shop man knows how easy it is to drill a hole considerably oversize by grinding one lip of the drill longer than the other. In fact, the drill is apt to cut a trifle oversize unless the grinding is well done. On soft materials the hole is likely to be small because of the walls closing in after being forced out by the drill. This varies with the sharpness of the drill.

Need for very accurate drilling depends on the nature of the work. In drilling holes for tapping a fine thread, a slight oversize may materially lessen the usefulness of the thread. Likewise, the size of the drilled hole affects the work left for the reamer or broach.

Those who have studied the question find that a properly ground drill will not drill more than 0.005 in. oversize in cast iron and steel. Some motor plants, while not establishing tolerances on all drilled holes, have certain jobs, such as holes for threading, where the size is held within 0.004-in. tolerance. On the whole, however, the general feeling seems to be that it is unnecessary to set tolerances on drilled holes except in some few special cases as already noted. It is felt that it is better to consider special the few instances where tolerances are necessary rather than to attempt to give tolerances on all drilled holes.

What About Merger?

THE desire for efficient control of distribution is mainly responsible for present day mergers, according to a report compiled by the Sherman Corporation, engineers, Boston, Mass. Typical opinions received from over 200 commercial and investment bankers were analyzed and presented in the form of a digest under the above title.

The advantages proven in degree by cases of successful mergers are: Reduction of costs and overheads; reduction of prices and, in consequence, broadened markets; the combination of diversified qualities of managerial abilities in a strong cohesive organization, increased diversity and strength of financial control, subtraction of duplications, whether of production or equipment, building, overheads, and selling costs; and increased profits.

Many factors cause mergers. Among them are: Growth of mass production and mass distribution; surplus of plant; necessity of meeting the competition of big business; changes in methods of distribution, notably the growth of chain distribution; the development of advertising; high cost of selling and distribution, resulting in part from duplication of effort by many competitors in the same market; inability of one or two executives to direct effectively all the functions of management, changes in character of goods consumed, and the growth of installment selling.

Generally, opinion among the bankers was in favor of prompt merger of manufacturers in kindred lines when the possibilities of expansion are distinctly limited. It was felt that such action is absolutely necessary to prevent complete disappearance of narrowing profit margins. The warning is given, however, that each concern, party to a merger, must be financially and economically sound.

With regard to the present merger trend, certain conclusions can be drawn. These are as follows:

1. Merger in the field of industry, offering limited expansion opportunity, is economically desirable, if it is provided with strong, capable management.

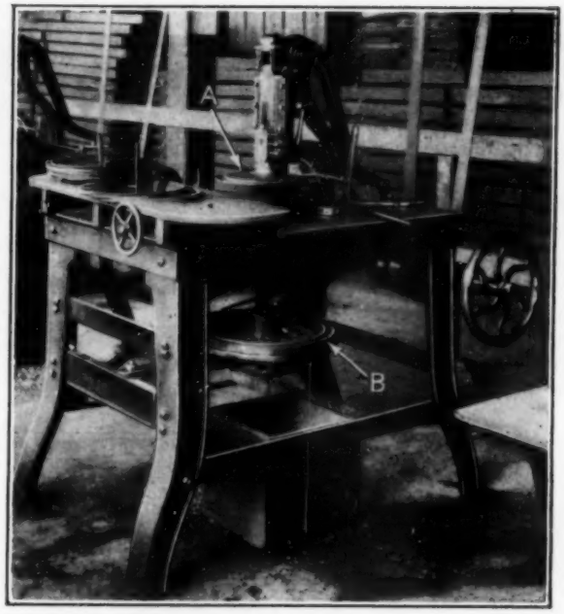
2. Scientific, preliminary analysis of all the factors in the proposed merger is essential.

3. The personal, human equation is the key factor in a merger and must be dealt with in a way that will assure thorough co-operation and unified control.

4. If a merger's primary objective is the sale of watered stock, it is economically and socially subversive.

5. The potential advantages to be gained from sound merger are today more in distribution than production, and perhaps the factor of greatest possible advantage is reduction of selling costs through the elimination of duplication of effort in the same territory.

The better the light, the quicker a toolmaker or an inspector can read his gages—and the fewer mistakes he will make.



Making Cotton Gin Saws *at Birmingham*

Fig. 1—Automatic punching presses for cutting teeth in gin saws

COTTON ginning today is a fully mechanical operation. Before the invention of the cotton gin the average output of a cotton-cleaning laborer in the South was one pound of cotton per day. The importance of this machine equipment to the cotton farmer may be judged by the fact that if hand-ginned the ordinary cotton crop of the United States would require the labor of fifty million persons during the crop season.

The heart of the cotton gin is the "saw," which is mounted on a revolving shaft and pulls the cotton fiber through iron ribs, leaving the seed to drop away. The number of saws mounted on the shaft is usually 80, although 60 or 70 may sometimes be used. In the "linters," which separate any remaining short fibers from the seeds, 106 saws are used. At the plant of the Continental Gin Company saws are made in three sizes, 10, 10½ and 12 in. in diameter, the more common size being 12 in. The saws are blanked singly in an ordinary power press from 0.037-in. blue-finish sheet steel of a hard temper, the blanks measuring ⅛ in. larger in diameter to allow for loss in cutting the teeth. The second operation consists in punching a 2⅞-in. diameter hole for the shaft.

Punching the teeth is next done on the automatic machines shown in Fig. 1. Each saw contains 264 teeth, which are punched one at a time. The saw blank is fastened under the plate *A*, and is indexed automatically by the index wheel *B* located under the table. The indexing is done during the up-and-down stroke of the press ram. The press operates at approximately 525 strokes per min, and the time for cutting the teeth in one saw is 30 seconds.

All saw teeth must be beveled on each side, and the back of the tooth also rounded on each side. This

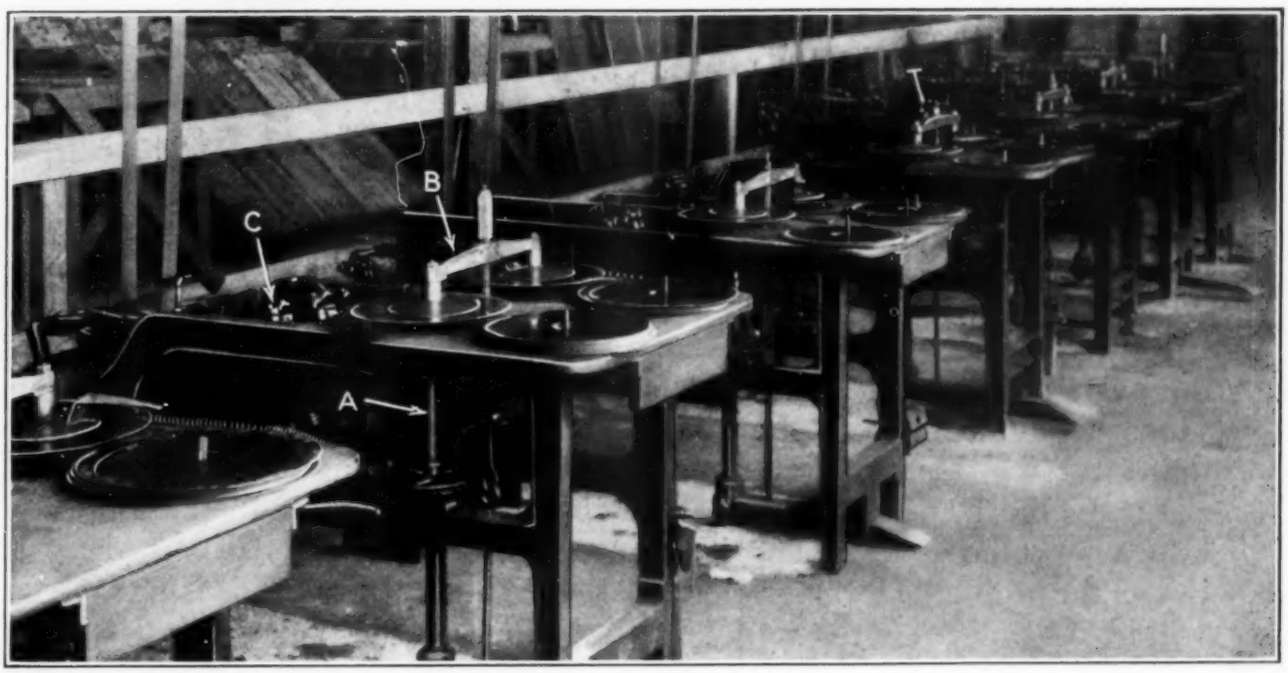


Fig. 2—Special automatic filing machines for beveling and rounding the back of the saw teeth

Fig. 3—Straightening gin saws after cutting

work is done in two operations on the automatic filing machines shown in Fig. 2. The saws with punched teeth are clamped on the shaft *A* by the double-clamp *B*, which is operated by a foot treadle. A 6-in. stock mill file is held in the reciprocating arm *C*, which automatically files the teeth back at the correct angle as the saw revolves. When one side is completed the machine stops, and the operator turns the saw over on the other shaft. Each machine, therefore, is filing both sides at one time. For the rounding operation the same type of machine is used, except that the reciprocating arm has also a rolling motion, and a 3-cornered file is employed. The file drops between the teeth and gives the rounded corner to the back of the tooth. The production of each machine is 25 saws per hour filed on both sides of all teeth.

The next operation is to remove the burrs from the teeth and smooth off the file marks. This work is done by mounting the saws, 70 at a time, on a shaft which is then placed in a box and revolved backwards at a speed of about 100 r.p.m. through an abrasive mixture of fine sand and iron filings. A few minutes' operation of the saws in the box produces the desired polish on the sides of the teeth, and takes off all of the burrs.

Saws that have been punched and filed are invariably distorted, and must be flattened. This operation is shown in Fig. 3. A round cast-steel anvil with a highly polished flat surface is used. The operation resembles that of straightening rifle barrels in that it depends entirely on the practiced skill of the operator. The operators are expert at the work, and can produce a flat saw with a minimum number of blows of the hammer. Each operator can straighten 30 to 35 saws per hour.

The final operation of making the saws run perfectly true on the gin shaft is shown in Fig. 4. The 80 saws are mounted on the shaft, being spaced apart by formed steel spacers, and clamped by a nut on one end. The shaft is then set on bearings on a special bench so that it can be easily revolved by the workman. A pointer is carried by the arm *A*, and indexed along the shaft *B*, so that it bears consecutively against one side of each saw. The operator revolves the saw shaft backwards by hand and twists the saw with a special tool until it runs perfectly true against the pointer. The average time of straightening the 80 saws on one gin shaft is 3 hours. For satisfactory operation of the cotton gin the saws must be accurately made, the teeth must be correctly formed, and each saw must operate perfectly true between the ribs of the machine.

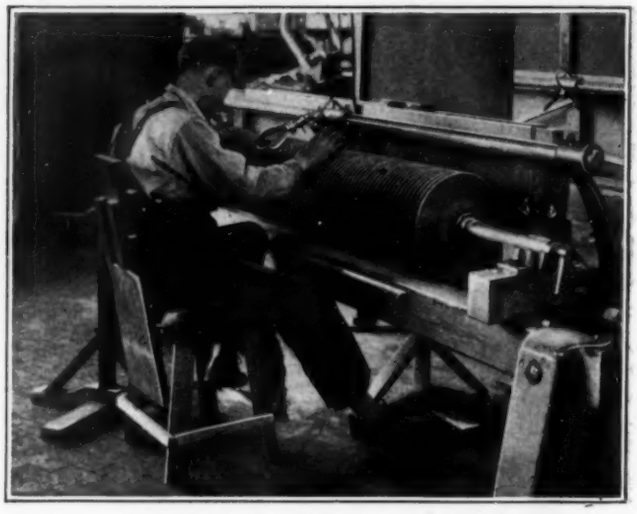


Fig. 4—Truing gin saws after assembling

Hob Design for Quiet Gears

Relief of gear teeth tips renders the gears more quiet in operation. How should the hob be designed so that there will be no abrupt transition on the gear tooth from the ordinary profile to the relieved portion of the profile? How many teeth will be in contact after relief?

Starting in this issue, a series of four articles will answer these and similar questions. The labor involved in the design of the modified hobs is greatly reduced by the complete set of charts included in the articles; and the use of the charts is fully illustrated by typical problems.

Locomotive Repairs at Little Rock

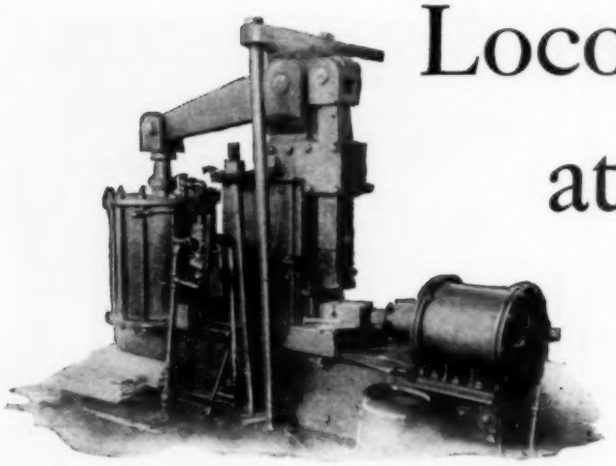


Fig. 6—An air-operated punch for cutting elongated holes in brake-rigging pins and guide bolts. One air cylinder is used to clamp the work, while the other cylinder operates the punch

BRAKE-RIGGING pins up to 1½ in. in diameter, and miscellaneous guide bolts have their elongated holes cut out in the air-operated punch, illustrated in Fig. 6, which is of home-made construction. The body of the machine is made of channel-iron sections to which two operating cylinders are attached. At the right is shown the 14-in. cylinder that is used to clamp the work. It operates a plunger to which the movable jaw is attached. The 22-in. cylinder at the left, through a plunger and a lever, operates the vertical ram to which the punch is connected. Control valves for both cylinders are located at a convenient point on the upright frame. In punching out a slot, the work is first heated to approximately 1,250 deg. F., and then is clamped firmly between the two jaws. Operation of the ram downward then causes the punch attached to it to pass through the center of the work. A considerable amount of time is saved in handling the operation in this manner.

Many of the furnaces in use throughout the blacksmith shop are equipped with air-operated doors, in order to facilitate their operation. The operating cylinders are located at the rear of the furnaces as illustrated in Fig. 7, which shows a double installation, using 10x12-in. air-brake cylinders. The chain anchored to one side of the cylinder passes over a roller connected to the plunger, and then around idler pulleys, the opposite end being attached to the furnace door. Control of the plunger is by a valve positioned at the operating side of the furnace, close to the door. A home-made device, built from an obsolete milling machine, and used for machining grooves in driving-box brasses after assembly, is shown in Fig. 8. With the driving box in place, an endmill located at the end of the spindle sleeve, is fed into the work to the proper depth. The endmill is driven by bevel gearing through a drive shaft housed in the spindle sleeves. The driving pulley is attached to the rear end. Slots cut in the outer face of the spindle bar at the center, into which a stationary roller fits, control the radial movement of the bar as it is fed horizontally by the handwheel *A*. Slots are provided for the milling of either straight or cross grooves.

Superheater units are tested by hydraulic pressure, ranging from 1,000 to 1,300 lb., as illustrated in Fig. 9. The open ends of the unit are held against a plate that has two openings corresponding to those in the unit. Clamping is accomplished by a hinged arm connected to the plunger of the upper air cylinder. Water is then passed into the superheater unit, after which pressure is applied by a plunger operated by the 8x10-in. air cylinder *A*. The projecting portion of the work is supported on a base made from an obsolete planer table. After a unit has been tested the water is forced out by air pressure. Approximately 4 min., floor to floor time, is required to test a unit.

Much time is saved by the device illustrated in Fig. 10, which is used for transferring wheel assemblies in connection with an overhead crane. It is shown with four sets of wheels suspended from it. The device has four

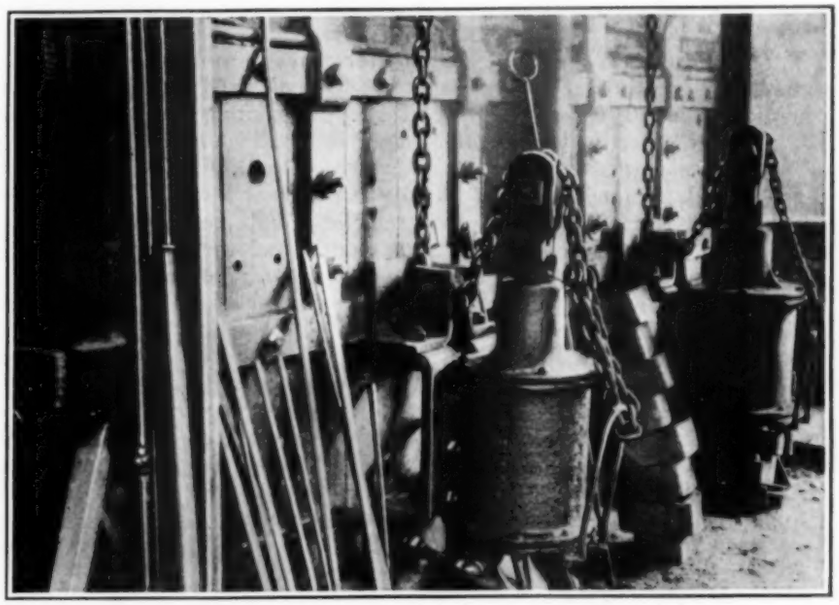
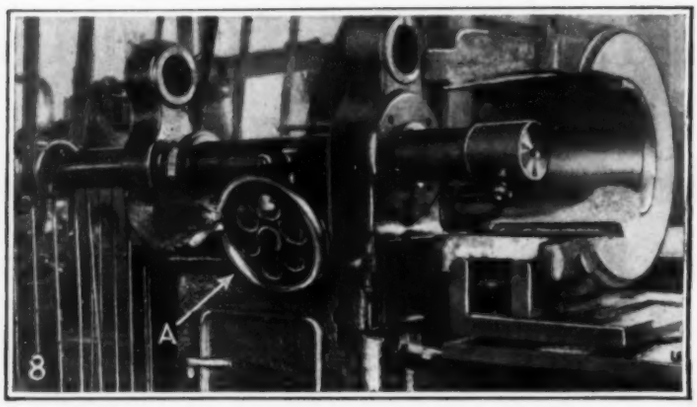


Fig. 7—The rear end of a pair of heat-treating furnaces, showing air cylinders used for operating the furnace doors. A roller is connected to the ram of each cylinder, over which the operating chain fits. Movement of the plunger causes the chain to either raise or lower the door, according to the direction of motion. A valve controls the plunger

Conclusion of the article.



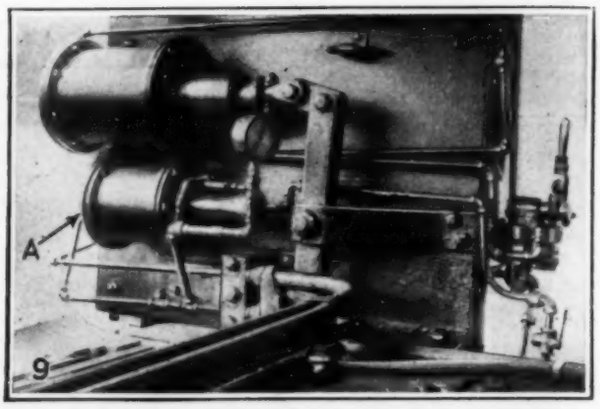


Fig. 8—Driving-box brasses are milled after assembly in the machine shown, constructed from an obsolete milling machine. An end mill is driven at right angles to the spindle. Radial movement of the end mill is controlled by a roller engaging a helical slot in the spindle. Fig. 9—Testing a super-heater unit by hydraulic pressure. Between 1,000 and 1,300-lb. pressure is applied. The unit is clamped to a plate by an arm connected to the upper air cylinder. The unit is filled with water, and the pressure is then applied. The water is ejected from the unit by air, after the test has been completed

pairs of tongs connected to its frame, which grip the load by the axles. In lowering the device, the tongs are in an open position, then after they have been straddled over the axles a man on the ground disengages a latch that causes the tongs to close, thus raising the load when the device is elevated. The tongs are self-aligning, so that little effort is required on the part of the operator in hooking a load. To unhook a load it is only necessary to engage a latch after the load has come to rest on the ground. Thus the job is made easy and safe at the same time, and the work of handling is expedited.

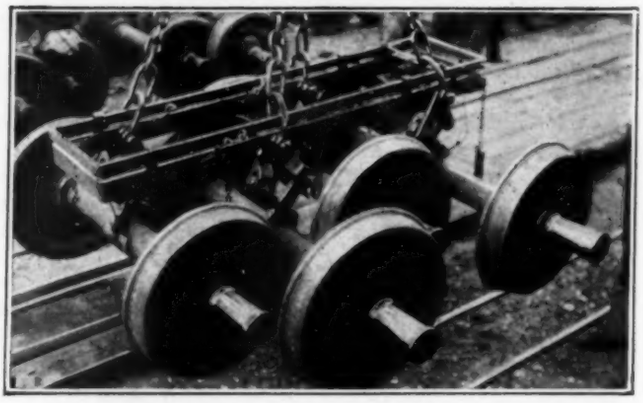


Fig. 10—A device for transporting four sets of car wheels at once by means of four pairs of tongs

The foregoing material was obtained through the courtesy of the Missouri Pacific Railroad Company at its Little Rock, Ark., shops.

Men Over Fifty—*Discussion*

By S. C. Martin

IT IS difficult and almost impossible for a man past middle age to obtain employment, even when possessed of considerable experience. One of the contributing factors to this situation is the compensation for accidents. A few years ago laws were passed which insured to the workman remuneration for an injury that was incurred while employed. Age renders the eye and the hand less quick and less sure than in youth, and the older man is not looked upon as a desirable employee to have around machinery. He is not only more liable to injure himself, but he becomes a greater risk to the safety of his fellow workers. The efforts he puts forth for greater caution are made at the expense of speed.

Another factor is employee insurance. Insurance rates in an organization where the majority of workmen are old men are very high, and unless the older men's efficiency is such as to offset the increased expense of maintaining their insurance, it would not be a wise policy to keep them on the payroll.

Since the close of the war, an increasing number of positions formerly filled by men are being filled by girls. Only a small number of these young women can be considered the chief support of a family. Since the majority are without responsibilities, their labor is cheap. It is of advantage to employ girls on some classes of work, and it is obvious that when the choice comes between the young man, the young woman, and the old man, the odds are against the last.

Another cause is probably due to the worker himself. Having been with the company for many years, and having many friends in the organization, he often takes it for granted that his position is secure. He does not work as energetically as he might, and perhaps is prone to criticism. The work that he has done for the company in years past has been paid for, and there is no reason why he should receive consideration over others for past efficiency.

In former years, the age limit was reached when a man was physically unable to work. Today, it is that age when circumstances connected with an industrial organization demand his replacement. The passing of the man of fifty is due to changing conditions and changing laws. Firms everywhere are establishing pensions for old employees. Why? Because there will be no work for them.

Being able to sell means having been sold. It's a hard job to sell something you don't believe in 100 per cent.

* * *

The Cadillac foundry uses five different kinds of sand for its castings in aluminum, bronze and iron.

Safety Code for Power Transmission

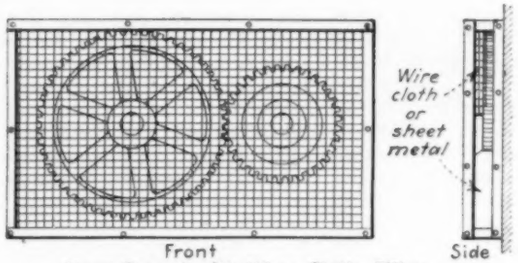
Approved by American Engineering Standards Committee

(Concluded from sheet No. 20)

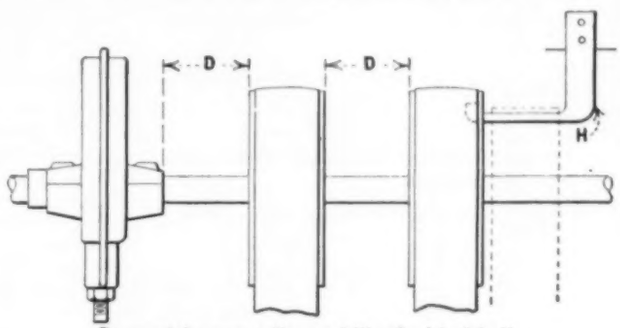
Tight and loose pulleys on all new installations should be equipped with a permanent belt shifter provided with mechanical means to prevent the belt from shifting from the loose to the tight pulley. Where loose pulleys or idlers are not practical, belt perches in the form of brackets, rollers, etc., should be used to keep idle belts away from the shafts. Belts which must be shifted by hand, and unguarded belts, should not be fastened with metal or any fastening which by construction or wear will be an accident hazard.

Minimum dimensions of materials for the framework of all guards shall be angle iron 1 in. by 1 in. by $\frac{1}{8}$ in., metal pipe of $\frac{3}{4}$ in. inside diameter, or metal construction of equivalent strength. All guards must be rigidly braced. Wooden guards are allowable only in industries where fumes or conditions of service would cause the rapid deterioration of metal guards. All metal should be free from sharp edges. Wire mesh should be of the type in which the wires are securely fastened at every cross point, except in the case of diamond- or square-wire mesh made of No. 14 gage wire, $\frac{3}{4}$ in. mesh or heavier. Guards for horizontal overhead belts should run the entire length.

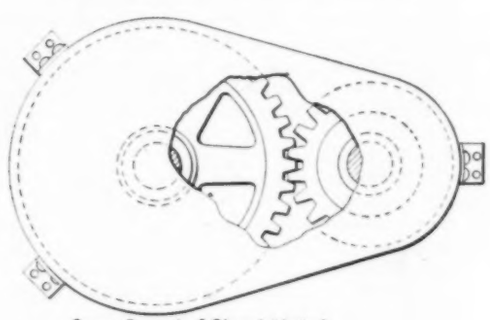
Guard rails should be 42 in. in height, with a mid-rail between the top rail and the floor. Posts should be not more than 8 ft. apart. If made of pipe it should be $1\frac{1}{4}$ in. inside diameter, or larger. Overhead rope- and chain-drive construction should conform to the rules for overhead belts, except that the filler materials should be of the solid type unless the fire hazard demands the use of open construction.

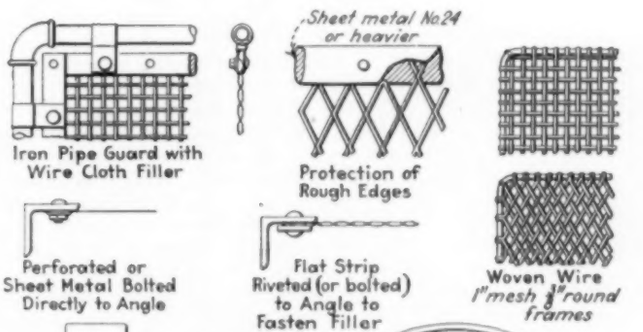


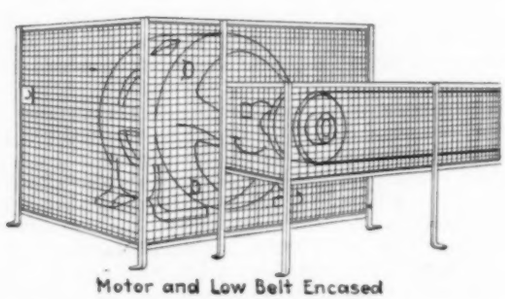
Gear Guard with Wire Cloth Filler

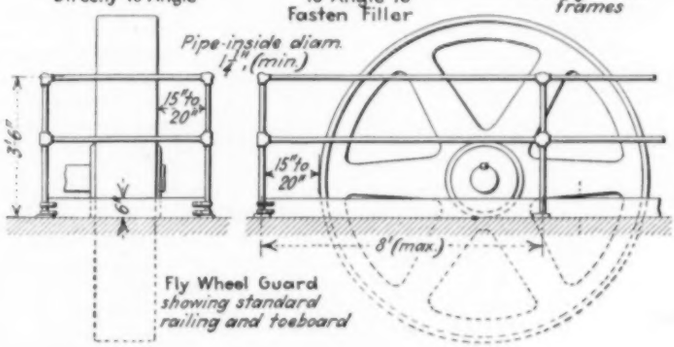


D must be more than width of widest belt
H belt hanger to hold idle belt


Gear Guard of Sheet Metal


Iron Pipe Guard with Wire Cloth Filler
Sheet metal No.24 or heavier
Protection of Rough Edges
Perforated or Sheet Metal Bolted Directly to Angle
Flat Strip Riveted (or bolted) to Angle to Fasten Filler
Woven Wire 1" mesh ⅛" round frames


Motor and Low Belt Encased



Fly Wheel Guard showing standard railing and toeboard

GUARD CONSTRUCTION

© American Machinist

· TECHNICAL · ABSTRACTS ·

Steels for Case Nitrification

The presence of vanadium in steel, in proportions such that a minimum amount, probably 0.04 per cent remains in solid solution, causes the case which is formed on low-temperature nitrification to be extremely hard and desirable. With the vanadium content mentioned, a hardness of Rockwell "C" 60 was obtained, which corresponds to 650 Brinell.

Hardness of the case increases with vanadium content, but decreases with increasing carbon content, the vanadium being constant. Additions of chromium, manganese and silicon increase the effectiveness of small quantities of vanadium in ferro-alloys of the casehardening type. When such inclusions are used, less than 0.4 per cent vanadium is necessary to obtain the maximum hardness. The hardness obtained is equivalent to that produced by nitriting aluminum-bearing steel. The depth of case is also important. A 0.50 per cent vanadium low-carbon steel was nitrited in ammonia at 950 deg. The depths of case after 2, 15 and 72 hours were 0.1, 0.3, and 0.5 millimeters.—A. B. Kinzel, *Transactions*, American Society for Steel Treating.

Lower Insurance Rates and Better Fire Protection

Modern materials-handling methods have brought with them advantages and disadvantages from the point of view of reduced fire risk. For instance, the conveyor that pierces a fire wall calls for one more opening to be protected, and effects the insurance rating accordingly. However, the main stream of progress in materials handling is favorable to a reduced fire risk. For example, if the stock is stored in a different department from one in which a hazardous operation is carried on, the over-all insurance rate goes down. Conveyors allow ready movement of stock and thus aid in insurance rate reduction as well as a decrease in the pay-roll.

The principle of getting material into and out of hazardous departments as quickly as possible is just as fundamental from the fire protection viewpoint as the rapid flow from incoming raw material to outgoing finished product is in manufacturing. Quick turnover within a hazardous department has the same monetary advantages as has the rapid turnover of capital within the entire business. Manufacturers frequently overlook the insurance saving that occurs by virtue of a speeding up of the flow of material due to improved handling methods. The faster the material goes through a plant, the less there is on hand at any one time on which insurance must be carried.

The large single-story plant has found favor now that large areas on one floor are not objectionable features in insurance rating. This type of construction, properly equipped with fire walls, is superior to multi-story buildings as far as fire loss is concerned.

One danger in the use of materials handling equipment is that such equipment allows too close packing of material. Many fire losses may be attributed to this. However, this disadvantage may be easily overcome by common sense storage methods. The added special hazards attributed to materials handling equipment are not commensurate with the advantages obtained.—J. A. Neale, *Factory and Industrial Management*, August.

Railroad Conducts Large Salvage Operations

In 1927, the total value of the output of the New York Central's reclamation plant at Cleveland, Ohio was computed at a cost price of new material as $1,090,045. The cost to the railroad was $519,434, and the saving was $570,-611. A total of 285 cars weighing 8,487 tons were reclaimed.

All material shipped out of the reclamation plant is marked up to the value of new material, whether it receives repairs at the reclamation plant, is returned to the railroad or factory for repairs, requires no reconditioning to render it serviceable again, or whether it can be considered merely second-hand material at best. The material is not returned to the storehouse at this value, however. It is delivered to various regions without charge except for the expense of doing the work as computed monthly, and prorated on a tonnage basis. It is charged not only for labor and for the new and scrap material used, but also for interest on the investment in facilities, taxes, depreciation, maintenance, insurance, switching charges, and hospital expense.

Since the plant was started in 1924, it has been increased from 9,000 to 18,000 sq.ft., and equipment and machinery added until the present investment in buildings and equipment, not counting land, amounts to $85,830. Metal buildings extend lengthwise of the shop yard, and are served on the side opposite the scrap yard by a depressed track where all shipping is done. A platform at the end of the building provides storage for repair parts, and ground space is also provided for materials awaiting reclamation.

The reclamation force is composed of 55 men. The large output for such a small force results from the completeness with which the plant has been equipped with machinery, all of which has been selected and arranged to reduce manual work to a minimum as well as to afford good workmanship.

Several valuable lines of equipment are reconditioned. In 1927, 133,000 nipples were made from old pipe. Large quantities of brass valves and fittings were reconditioned, the total reaching 11,000 pieces. By far the largest operation is that of repairing brake beams of which 44,400 were placed in service again.

At Cleveland no material is reclaimed or shipped unless there is an order on file for it. It is emphasized that recoverability or repairability does not necessarily mean usability, and the reclamation operation must be controlled to avoid needless expense to the company. A regular order comprises a memorandum giving a record of the past 12 months' consumption and the quantity on hand, and the estimated requirements for the next 12 months. This slip is the authority to forward such material currently until the requirement is filled. The plant is informed when pieces have become obsolete.—*Railway Age*, August 25.

Aluminum Drawing and Stamping

In draw-press work on aluminum, lubrication is important; the metal cannot be worked dry since if so handled, it builds up on the die and causes scratches. Many different lubricants have been used, but it may be said in general that for deep drawing a thick lubricant like vaseline or heavy to medium machine oil is suitable, while in shallow stamping a thinner oil such as kerosene is satisfactory. Lard oil, light machine oil and so-called "metal oils" have been used with satisfactory results. Some soluble oils have also been found suitable.

In deep drawing the lubricant should be applied to both sides of the blank, and also to the die and punch. A fast method of lubricating blanks is to pass them through felt-covered rolls soaked in oil. The lubricant may be removed later by washing in benzine, gasoline or soap water, and by drying in sawdust.

The bulk of the deep-drawing work is done with dead-soft material, while various intermediate tempers are used for shallow stampings. Dead-soft aluminum has a Shore scleroscope hardness of from 5 to 7 depending on the gage. Usually the temper of the stock used is such that the hardening caused by drawing makes the finished product quite hard and rigid, and in any given case various tempers should be tried to obtain the best results.

Drawability of the metal is not indicated by the hardness tests. It is reliably indicated, however, by the cupping test, such as is made on the Olsen ductility or Erichsen cupping machines. This test simulates the actual drawing process, and indicates inferior drawing qualities.—Dr. Robert J. Anderson, *Metal Stampings*, July.

IDEAS · FROM · PRACTICAL · MEN

The department, "Ideas from Practical Men," is devoted to the exchange of information on methods useful to the machinery industries. Its scope includes all divisions of the metal-working industry, from drafting room to shipping platform. Descriptions of methods or devices that have proved their value are carefully considered, and those published are paid for. The rates are from a minimum of five dollars upwards, depending upon their merit

A Turning Operation in a Milling Machine—*Discussion*

By H. G. Downs

Referring to the problem of O. S. Marshall on page 212, Vol. 69, of the *American Machinist*, I find that time may be saved on like operations by the use of a hollow mill, which may be made from stock drill rod as quickly as grinding and setting a turning tool, at the same time giving uniform size without further adjustment. It may then be useful also on future work.

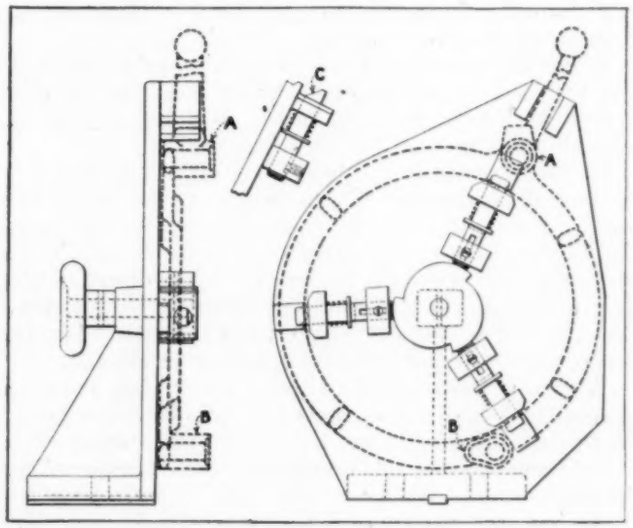
Another advantage of the hollow mill over the turning tool in addition to the reasons mentioned is that in the event of an irregular contour on work to be cut the spring-away effect of a turning tool is removed, and a true cylinder may be formed at a single cut.

A Quick-Acting Grinding Fixture

By H. F. Malone

A fixture for the rapid handling of very light castings in disk grinding, is shown in the illustration. The work, shown in heavy dotted lines, is of thin ring-section having a hand knob protruding from the boss *A*. The boss together with a corresponding boss *B* is to be disk-ground at the end.

The fixture is located on the machine by a steel key. The work is put in place with the handle end between two lugs cast on the fixture, which counteract any tendency of the part to slip. The work is seated against three pads by means of three pins having beveled edges, as shown at *C*. The pins are forced outward to grip the work by the three-lobed cam in the center, which is operated by a hand knob. The cam forces the pins out equidistantly, centralizing the work and clamping it securely against the pads.



Fixture with the work in place

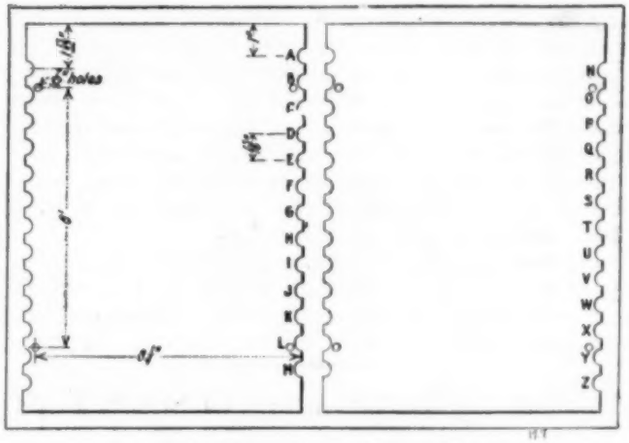
Springs keep the clamping pins in contact with the cam at all times. This method insures uniform clamping of the work at three points, thus minimizing distortion. It must be borne in mind, however, that in devices of this type, the inclination of the cam lobes should not be so great that there will be a tendency for the clamping pins to work loose.

Filing Magazine Articles

By John F. Bell

Perhaps the readers of the *American Machinist* will be interested in the method I have adopted for filing and indexing articles in pages clipped from that journal.

I took a sheet of aluminum $\frac{1}{8}$ in. thick, and after drilling four $\frac{7}{32}$-in. and $26\frac{1}{2}$-in. holes, it was trimmed to



Templet for cutting index partitions

the size of the pages as clipped from the magazine. In trimming the templet the $\frac{1}{2}$-in. holes were cut through the center, leaving half-holes as shown in the sketch.

With the aluminum sheet as a templet, pieces of cardboard were marked off and two of the $\frac{7}{32}$-in. holes and one of the half-holes were cut in each piece by suitable punches. The $\frac{7}{32}$-in. holes are for the wires of my binder, while the half-holes are for a thumb index. To the left of the half-hole in each piece of cardboard I typed a letter of the alphabet. The half-holes are staggered on opposite sides of the templet, one side of which is used for any one of the half-holes covered by one of the letters in one-half of the alphabet. In marking the half-holes corresponding to the other half of the alphabet,

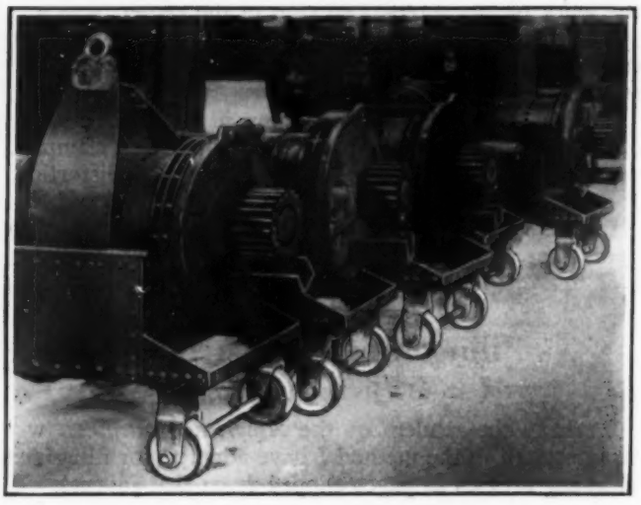
the templet is turned over. The necessity for turning the templet over is the reason for making the four $\frac{7}{32}$-in. holes for the binder wires.

Of course, the position of the half-hole in any one piece of cardboard is determined by the person filing the article and the letter under which he wishes to file it.

Handling Armatures in a Railway Shop

By C. W. Squier

The method used by the Brooklyn-Manhattan Transit Company in handling armatures in its new shops at Coney Island is of special interest, both because of the way in which it effectually prevents injury to the armature and also in the utilization of floor space. The armatures are handled by an over-head traveling crane, using the type of sling shown at the left. These slings enable the craneman to lower the armature directly into its cradle on the truck. The truck is of three-wheel construction, so that it can be easily towed or rolled to the desired point. The cradle and the truck are of steel plate, reinforced with suitable angles.



Truck for railway-motor armature

The company also uses another type of truck, consisting of an angle-iron framework and having four wheels. The ends are made of steel castings that receive the armature shaft.

Preventing the Breakage of Small Taps

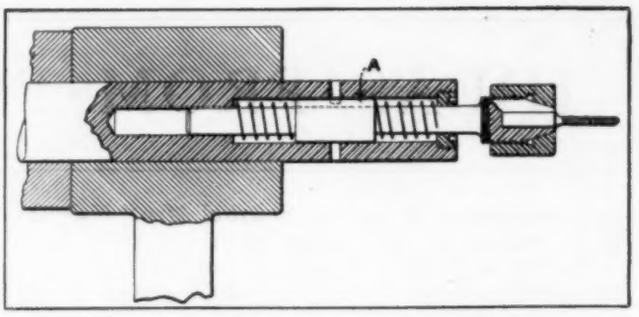
By J. E. Fenno

An alteration to a tapping machine to prevent the breakage of small taps, is shown in the illustration.

The spindle of the machine was rebored for a sliding fit for both diameters of the plunger *A*. To prevent the plunger from turning independently of the spindle, a keyway was cut in the larger diameter, and a flat-ended pin through the wall of the spindle acted as a key.

Helical springs were placed on the reduced ends of the plunger, which was held in place by a threaded bushing in the end of the spindle. The chuck is of standard design and requires no description.

In tapping, the end pressure necessary to start the tap in the work compresses the rear spring, providing a cushion effect that makes the start easy. When the machine is reversed and the tap comes out of engagement with the work, the front spring, having been compressed by the motion necessary to reversal, forces the plunger into the spindle quickly and prevents the tap from catching as it leaves the work.

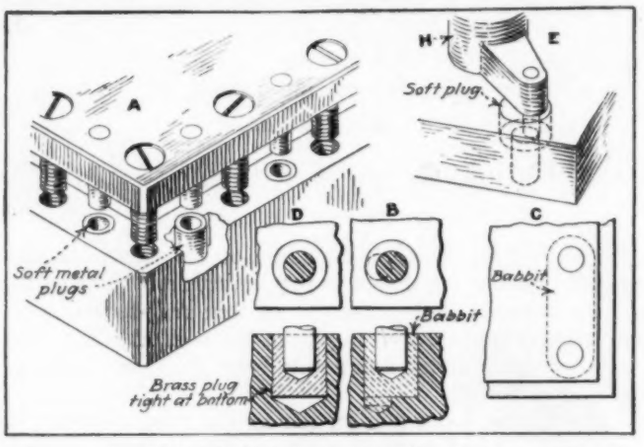


Altered spindle of the tapping machine

Soft-Metal Seats for Locating-Pins

By Henry Simon
Jena, Germany

Considerable difficulty is sometimes experienced in locating two parts upon each other by dowels, especially when both parts are hardened, or where a soft matching part cannot be drilled from the hardened piece. With hardened parts as well as soft, trouble arises when for any reason it becomes necessary to shift the relative location of the pinned parts.



Soft-metal seats for locating-pins

If the lower part is soft, a common remedy is to drill out the locating-pin hole to a larger size, plug it, and redrill the hole in the right place. But this way is not possible when the part has been hardened.

In the illustration is shown how, by providing for soft-metal locating seats in the design, a makeshift remedy is converted into a desirable feature. In this way, the locating area can be planned so as to be right as to size, shape and position. In some cases, the design of the part in which it is placed may be modified if necessary. The greatest advantage, however, is with hardened parts, where a great deal of difficulty can often be avoided.

A case is shown at *A*, where a cover plate must be accurately located on a hardened, box-like lower piece. With parts of this nature, distortion in hardening is so certain that dowels are usually not even considered as locating means. By using soft steel or brass plugs as seats, however, the use of dowels is rendered practicable, and an accurate job can be produced at low cost.

The nature of the work will determine the proper metal to be used for the plugs, as well as other details. Usually brass can be used, but soft steel may be preferable where racking strains have to be reckoned with. In some cases, the plugs may be made by pouring babbitt in, cavities of special shape, as shown at *B* and *C*. Ordinarily, turned plugs may be made a light force fit in the holes, but with delicate and accurate work, it will be necessary to see that the fit is such as not to develop undue strains in the piece in which the plugs are seated. Where precision is required, the holes in the upper piece, as well as the ones in the lower piece for the plugs, may have to be lapped to roundness.

Wherever possible, the plugs should be made long enough so that they are left with solid bottoms when the holes for the dowels have been drilled, as at *B* and *D*. As indicated, the plugs should be made tightest at the bottom, because there pressure of the force fit is likely to cause the least amount of distortion, while on the other hand it will not be released by the subsequent drilling. Where a babbitt plug is used, a smaller shallow hole may be drilled off center in the bottom of the seat, as at *B*, to prevent any possibility of the plug turning.

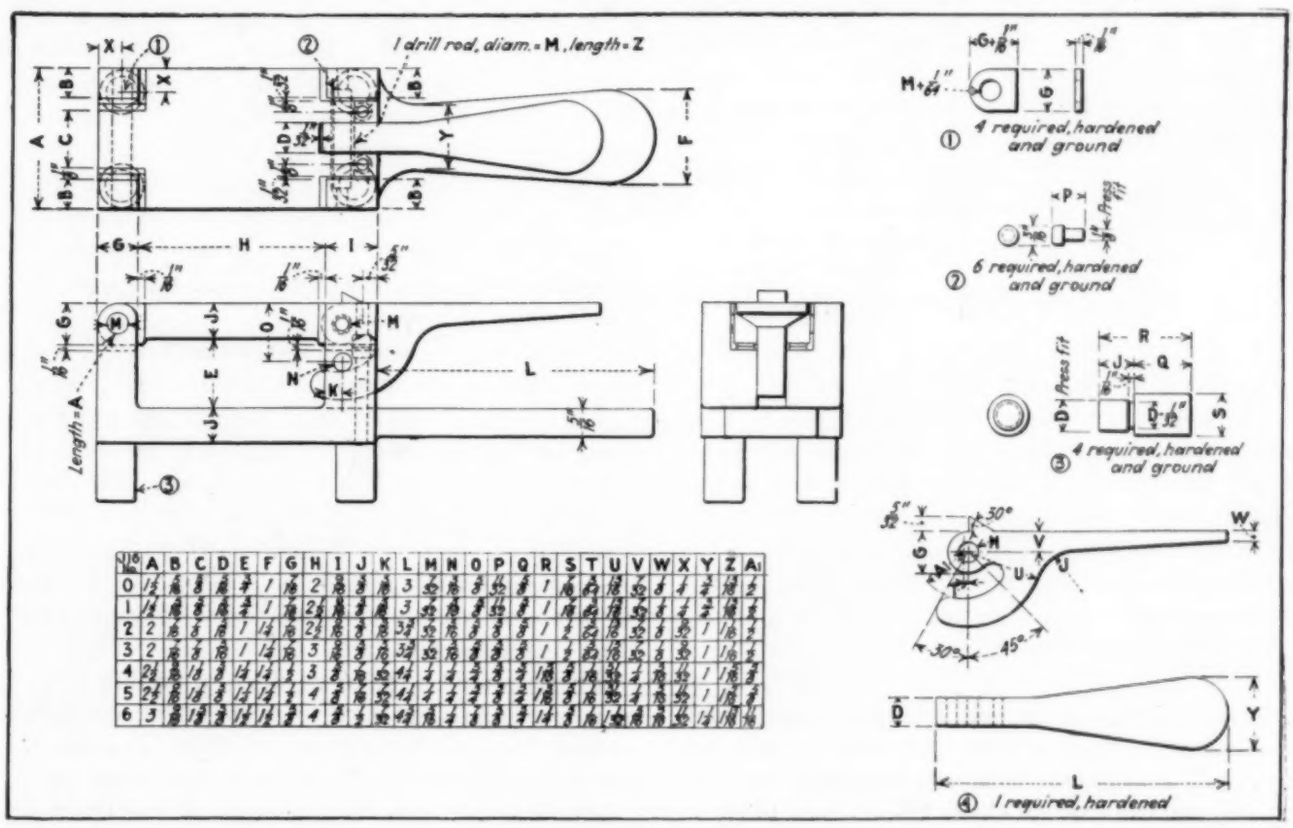
Another application is shown at *E*, where a locating pin and a seating plug are used to fix the angular position of the arm of the pivoted member *H*. A knockout hole is provided for the plug so that it can be instantly replaced by a new blank when it is desired to change the location of the arm. In this case, the method of locking is not only simpler than almost any other scheme, but is also more positive than if opposed screws were employed, since a deliberate change in the plug must be made in order to change the location of the arm. The trouble arising from shifting parts is thus eliminated.

Standardized Leaf-Jigs With Cam Locks

By E. F. Eberhard

The chart shown in the illustration has been used successfully by the writer to facilitate the design of the type of jig indicated by the drawing. The component parts of the jig, some of which are detailed, are lettered to correspond with the letters at the top of the chart. Jigs of suitable proportions can be chosen from the first vertical column, the sizes being numbered from 0 to 6. As jigs of this type are in universal use in the plant where I am employed, it was found advisable to stock the different sizes, the tool draftsman having to merely lay out the jigs to chart sizes and insert suitable work nests. By this means much work in the drafting room was eliminated and jig fabrication was speeded up.

The bodies of the jigs are of cast iron and carry steel leaves, the proper alignment of which is insured by the renewable hardened and ground pins 2, which are a close fit against the ends of the hardened cam-lever pins. Pins of the same style and size are used as stops for the leaves in the closed position. Provision is made for wear at the leaf hinge by the hardened washers 1, their flat projections being locked against the jig bodies and the leaves, respectively. As the locking arrangement for the leaves is of standard design, the cam being detailed, it can be made readily by any toolmaker.


1 drill rod, diam. = M, length = Z
Length = A
4 required, hardened and ground
6 required, hardened and ground
4 required, hardened and ground
1 required, hardened

No.	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U	V	W	X	Y	Z	A1
0	1½	⅜	⅜	⅜	¾	1	⅜	2	⅝	⅜	⅜	3	25/32	⅝	⅜	⅜	⅜	1	⅝	29/32	13/16	25/32	⅜	¼	¼	3/16	½
1	1¾	⅜	⅜	⅜	¾	1	⅜	2½	⅝	⅜	⅜	3	25/32	⅝	11/32	⅜	⅜	1	⅝	29/32	13/16	25/32	⅜	¼	¼	3/16	½
2	2	⅜	⅜	⅜	1	1¼	⅜	2½	⅝	⅜	⅜	3 3/32	25/32	⅝	⅜	⅜	⅜	1	½	29/32	13/16	25/32	⅜	5/16	¼	1/16	½
3	2	⅜	⅜	⅜	1	1¼	⅜	3	⅝	⅜	⅜	3 3/32	25/32	⅝	⅜	⅜	⅜	1	½	29/32	13/16	25/32	⅜	5/16	¼	1/16	½
4	2½	⅜	⅜	⅜	1¼	1¼	½	3	⅝	⅜	⅜	3 3/32	25/32	⅝	⅜	⅜	⅜	1	½	29/32	13/16	25/32	⅜	5/16	¼	1/16	½
5	2½	⅜	⅜	⅜	1¼	1¼	½	4	⅝	⅜	⅜	3 3/32	25/32	⅝	⅜	⅜	⅜	1	½	29/32	13/16	25/32	⅜	5/16	¼	1/16	½
6	3	⅜	⅜	⅜	1¼	1¼	½	4	⅝	⅜	⅜	3 3/32	25/32	⅝	⅜	⅜	⅜	1	½	29/32	13/16	25/32	⅜	5/16	¼	1/16	½

Sketch and chart for leaf-jigs of various sizes

American Machinist

Editors: KENNETH H. CONDIT AND FRED H. COLVIN

Established 1877

Currency Stabilization

MOST encouraging is the conclusion reached by the Federal Reserve Board, in a study just completed, to the effect that the recent redistribution of gold has reduced currency fluctuations throughout the world. Different countries have different definitions of what constitutes a gold standard but the practical effect is that world trade and industry is relieved, to a considerable extent, of the great handicap of uncertainty as to prices of raw materials and finished products alike.

It has long been a commonly accepted saying that business can adjust itself to almost any obstacle or difficulty so long as it remains fixed and can be reckoned with. Uncertainty, on the contrary, will slow down any enterprise. No business man will go ahead with boldness if there are many indeterminate factors in his commercial equation. Make them determinable, even if adverse, and he can govern himself accordingly.

Currency fluctuations are particularly difficult to cope with in the manufacture of any product, like machinery, where a considerable period must elapse between the placing of the order and the shipping of the goods. Foreign trade in such fields should be greatly stimulated by the removal of the danger of wide exchange variations.

Paying for Skill or Scarcity

REMUNERATION that is fair to all concerned is difficult of determination. The wide gap that exists between railroad shop mechanics and plasterers, as an example, is not easily reconciled. It is probably safe to say that the machinist in the railroad shop must be versed in many more kinds of work and be capable of far greater accuracy than the plasterer. And yet the latter usually receives at least twice the hourly rate of the machinist.

The manager's viewpoint, naturally and of necessity, considers the going wage in his or similar industries, rather than the relative skill and pay. If he is manufacturing a product in large quantities, the cost of direct labor is not likely to be one of his major items of expense, and the rate per hour or per piece is not particularly important. In a shop of the railroad type, the condition is entirely different. The only products, as tersely stated by a railroad shop executive, are transportation and scrap. Manufacturing is almost unknown. The work is to repair locomotives so as to keep them in service at the least expense. Direct labor is a much larger percentage of total cost than in manufacturing plants. These different conditions present a difficult problem to any management, even those with advanced ideas as to fairness and equity.

The skilled worker, on the other hand, cannot help feeling aggrieved at the discrimination. Nor can he be blamed for legitimate efforts he may make toward securing a wage commensurate with his skill, as compared with the plasterer before mentioned. It is not a problem to be lightly dismissed with parrot-like phrases about supply and demand, because supply can be artificially restricted with results that are rarely satisfactory to either side. Calm discussions, forbearance, and a spirit of fair play should accomplish more than arbitrary actions on either side.

Measurement or Guess

NO LESS an authority on research than Charles F. Kettering pointed out in a recent speech that in the absence of measurement opinions must be accepted. And that, of course, is what makes horse races. You can't measure horse psychology accurately. Neither can the average bettor know to what extent the race has been fixed beforehand. Therefore one man's opinion on which horse will win is as good as another's, provided, of course, that he has not been a party to the fixing process.

Unfortunately, some industries and not a few businesses are conducted on much the same lines as a horse race. Basic facts are missing and the future policy is dictated by opinion or guess.

Under Secretary Hoover's direction the Department of Commerce has done much to substitute facts on markets, at home and abroad, for the opinions that used to be the only authority. Trade associations are doing good work in supplying their members with measured facts.

There is still a lot to be done in finding ways of measuring things hard to measure, but we shall at least have made a start if we accept as a standard the motto in Mr. Kettering's own laboratory, "Opinions will only be tolerated in the absence of facts."

Herbert "Cloudburst" Production Hardness Tester

PRODUCTION hardness testing of the entire surface of specimens up to 8 in. square can be performed with the Herbert "Cloudburst" production hardness tester, which is being manufactured in this country by the Tinius Olsen Testing Machine Company, Philadelphia, Pa. It was developed and patented by E. G. Herbert of England. The surface to be tested is exposed to a rain of from 10,000 to 20,000 steel balls which are 3 mm. in diam. The height from which the balls are permitted to fall is arranged so that their impact is sufficient to mark the surface of the specimen if it is below a specified degree of hardness. Soft spots are revealed on the polished specimen by local roughness caused by numerous slight indentations. No direct measurement of the hardness is given by the machine shown in Fig. 1. It is necessary to employ the projection microscope illustrated in Fig. 2 for measuring the hardness of the piece, and fewer balls are used in the Cloudburst so that the indentations do not overlap.

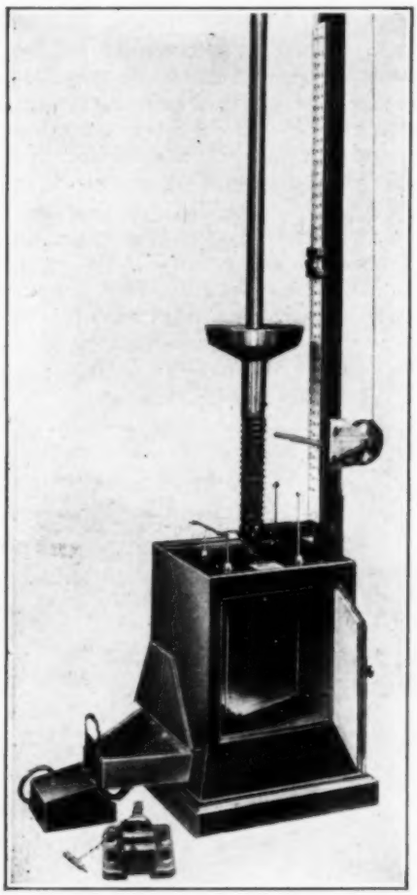


Fig. 1—Herbert "Cloudburst" Production Hardness Tester showing the tilted work platform within the rubber-lined box

As shown in Fig. 1, the tester consists of a rubber lined box inclosing a swinging platform on which the work is placed. This platform can be oscillated back and forth beneath the vertical tube, 2 in. in diam., through which the balls fall to the surface. Only the lower portion of the tube is visible in the illustration, the actual height being 13 ft. so that a clear fall of 4 meters can be had. The exact height from which the balls drop is determined by a perforated piston inside the tube, the height of the piston being adjustable by means of a cable coupled to the indicator on the scale.

Cycle Completed Easily

To transfer the balls to the upper side of the piston, they are poured into the hopper surrounding the tube and elevated to the top by means of a cable. At this point they fall through ports in the tube and on to the piston, from the perforated face of which the effective fall is measured.

It will be noted in Fig. 1 that the platform supporting the work is tilted to cause the balls to rebound towards the front of the box so as not to interfere with the remainder. The supporting rods are mounted on ball joints above the box so that they may be oscillated freely. The balls discharge through the inclined chute into a hopper. For production work two work tables may be employed, one in use while the other is being loaded. If desired, the balls can be loaded into the tube by means of a motor-driven conveyor.

Where it is required to measure the actual hardness, or the limits of hardness, the projection microscope shown in Fig. 2 is employed. This device gives a magnification of 20 times. As mentioned above, fewer balls are used so that the indentations do not overlap. The essential feature of the apparatus is a large ruled screen upon which the image of the indentation is projected. For testing maximum and minimum hardness, two sets of diagonal lines are ruled on the screen, one set being spaced to represent maximum hardness and the other one minimum hardness. The short diagonals are 0.6 mm., while the long diagonals are 0.7 mm. The magnifying power of 20 gives lines spaced 12 and 14 mm. apart, respectively, so that rapid and accurate inspection can be made without eyestrain. The eyepiece is adjusted to bring any particular image into position so that it touches two adjacent diagonal lines. If the image is within the longer dimension and exceeds the short dimension, the area under consideration is within the hardness limits specified. In Fig. 3 is shown a section of the magnified screen. Screens can also be supplied for indentations made on the Brinell testing machine.

Fig. 2—Herbert Projection Microscope shown in use for measuring the indentations on the polished surfaces of valve tappets. The pieces were tested in the Herbert "Cloudburst" Production Hardness Tester

Work hardening of certain jobs

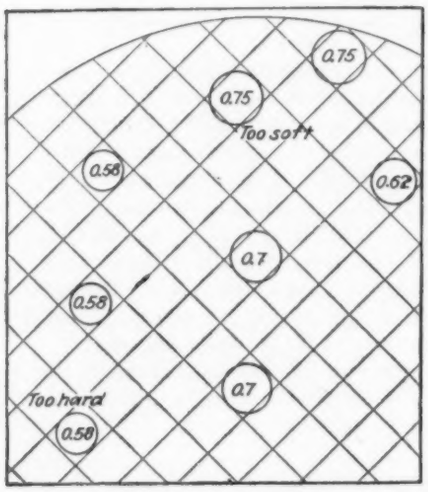
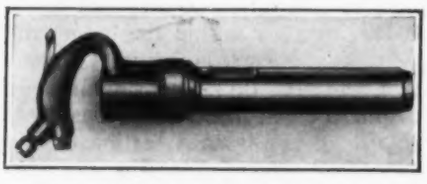


Fig. 3—Section of the magnified screen used in the Herbert Projection Microscope showing how easily hard and soft spots in the specimen are picked out

can be done with the "Cloudburst" machine. The process is essentially the same as for hardness testing, but the fall of the balls begins from a lower height than for testing, and is gradually increased as the work-hardening process proceeds. The degree of hardness that can thus be produced depends on the material, and is determined beforehand by means of the Herbert Pendulum hardness tester. In one particular case a hardness of 630 Brinell was produced, which was within 12 per cent of the maximum of 710 Brinell.

Ingersoll-Rand Riveting Hammers

Four sizes of these riveting hammers, having strokes of 5, 6, 8 and 9 in., have been developed by the Ingersoll-Rand Company, 11 Broadway, New York, N. Y. According to the manufacturer they are powerful, easy to operate, and have low air consumption. One improvement is the handle, which is kept tightly in place by a spring locking device. It is threaded on to the barrel, and the spring lock not only prevents the handle from unscrewing, but applies tension to tighten it automatically.



Ingersoll-Rand Riveting Hammer having an outside open-type trigger handle

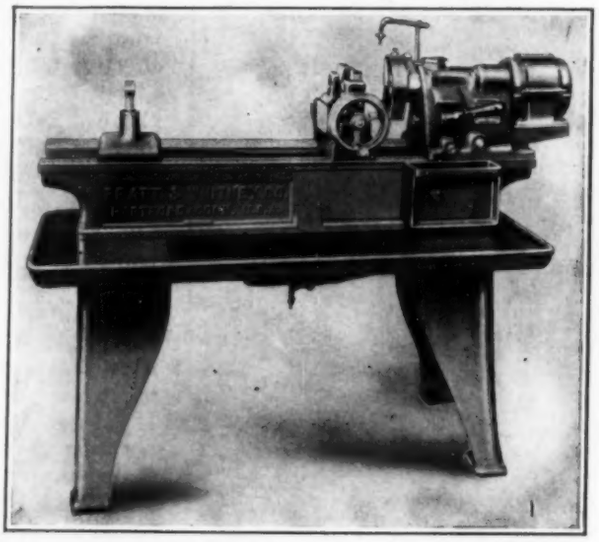
The valve operates in a hardened and ground valve box located at the head of the barrel, and is clamped in place by the handle. The valve has large bearing surfaces, and is designed to be free from holes or ports from which cracks could start. The valve box has a solid upper end which provides a positive compression chamber for the piston on its up stroke. This feature acts always to prevent the piston from striking the handle end. The barrel is made of special steel, heat-treated and ground. An open-type outside trigger handle is furnished as standard, but closed or inverted type handles can be supplied.

Pratt & Whitney Model B Single-End Hand-Centering Machine

WORK up to 4 in. in diam. can be held in the V-jaws of the self-centering vise used on this machine. The model B hand-centering machine has been introduced by the Pratt & Whitney Company, Division of Niles - Bement - Pond Company, Hartford, Conn. As shown in the illustration, it is single-ended and motor driven. The vise is operated by a handwheel, and can be adjusted to any position along the bed. The drill head is of a compact design, and a ½-hp. motor, running at 1,750 r.p.m., drives the spindle through reduction gearing, at a speed of 1,000 r.p.m. The reduction gearing consists of an elongated steel pinion mounted on the motor shaft and meshing with a fiber gear on the drill spindle. Timken bearings support the spindle which has a sliding sleeve that permits the drill to be advanced for 1½ in. The end of the spindle is hexagonal in form to provide an easy means of holding when tightening collets. The drill head and integral motor drive is mounted at the right-hand end of a heavy, cast-iron bed provided with a pressed steel oil and drip pan. A reservoir for cutting fluid is located in the chip pan. A plunger pump at the rear of the head is connected to the reservoir. This pump is operated by the same lever as the spindle, so that at every advance of the spindle a stream of cutting fluid from the reservoir is supplied automatically to the drill. The lever controlling the plunger pump and the spindle operates through a 45-deg. spiral rack and pinion. A spring safety device controls the pressure that can be exerted on the drill.

An adjustable stop is provided at the spindle nose, by means of which the depth of holes may be kept constant. It can be mounted to engage either the end of the work or a seat on the head. The latter arrangement is particularly useful when centering irregular forgings or castings. To hold the outer end of the work, a V-support is provided. It is adjustable vertically, and can be moved to any position along the bed. For work that is more than 5 ft. long, a floor stock support can be furnished.

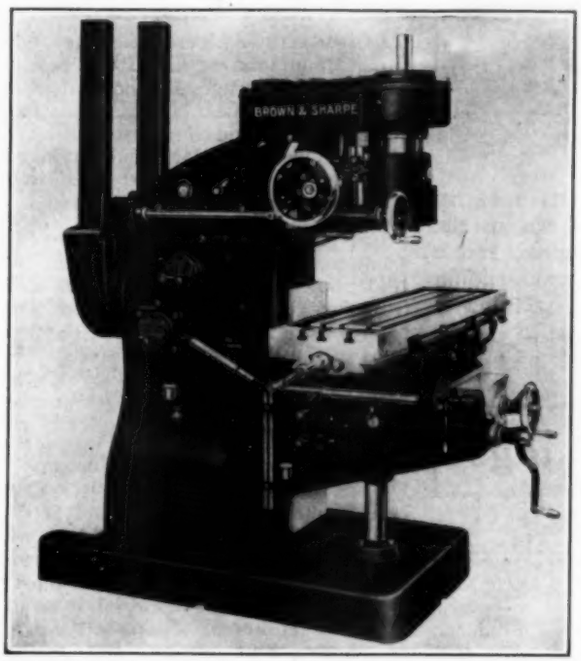
The floor space required is 60½x 29½x45 in. The weight is 750 lb. net. A 6-in. vise can be supplied.



Pratt & Whitney Model B Single-End Hand-Centering Machine

Brown & Sharpe No. 2 "Standard" Vertical-Spindle Milling Machine

DUAL control for feed changes has been incorporated in the No. 2 "Standard" vertical-spindle milling machine, which has been placed on the market by the Brown & Sharpe Manufacturing Company, Providence, R. I. This machine is an addition to the "Standard" line, and has many features common to it. Two operating positions are provided, one at the front and one at the rear of the table. Speed changes in two series are made by a single lever at the side. The rates of feed or speed are indicated by direct-reading dials located above the control levers. Power fast travel for longitudinal, transverse and vertical movements is controlled by a single lever. The knee elevating screw does not extend below the base.



Brown & Sharpe No. 2 "Standard" Vertical-Spindle Milling Machine

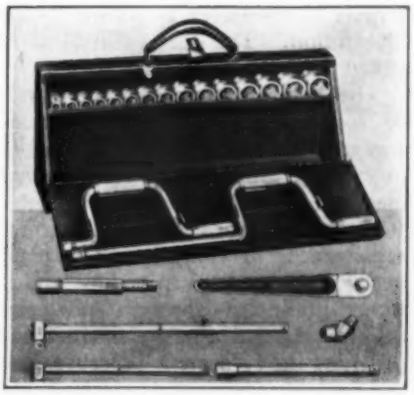
Automatic disengagement of the power fast travel with simultaneous engagement of the cutting feed desired occurs at a predetermined point for each set-up. This feature frees the operator for work on other machines, and also prevents damage to the work and cutter, which would result if the power fast travel should cause the cutter to engage the work.

Filtered oil is provided by an automatic lubrication system to all mechanisms within the column, and to the driving pulley. A separate pump supplies lubricant to the knee assembly. A single oil pocket lubricates the table and saddle bearings.

An automatic feed is provided for the spindle which can be controlled readily from either operating position. This spindle feed is provided with an automatic release operating at any point of the travel. The spindle has a telescoping guard. The spindle head is counterbalanced, and is provided with a micrometer stop for controlling the depth of the cut. As shown in the illustration the machine is equipped for belt drive, but it can be fitted for or equipped with a motor. When belt driven the power is transmitted from the driving pulley through gears to the spindle and the feed and power fast-travel mechanisms. When motor driven, the ventilated base compartment contains the motor which drives through chain and sprockets. Adjustment of the tension of the driving chain is secured by a screw located on the outside of the motor compartment. The entire drive is adequately guarded.

"Husky" No. 696 Socket Wrench Service Kit

Socket wrenches up to 1¼ in. hexagon are furnished with this service kit, which has been placed on the market by the Husky Wrench Company, Milwaukee, Wis. A 15-in. combination T is provided. The brace and speeder are attached with clips to the cover so that they will not interfere with the accessibility to the inside of the box. No partitions are placed in the lower part of the box, so that a maximum amount of space is available. The sockets are arranged on the upper shelf, all openings facing towards the front for easy selection.



"Husky" No. 696 Socket Wrench Service Kit

The set is packed in a carrying case made of 20-gage sheet steel finished in black lacquer, and is equipped with a hasp for locking purposes. A leather-covered handle is provided.

"Industrial" Classes 8526 and 8536 A.C. Automatic Starters

Three types, push-button in cover, without push-button, and three-point switch in cover, of these classes 8526 and 8536 a.c. automatic starters have been announced by the Industrial Controller Company, Milwaukee, Wis. The type having a three-point

"Industrial" A.C. Automatic Starter having three-point switch in cover

switch in the cover is shown in the illustration. The case is finished in baked enamel.

These starters supersede the classes 8527 and 8537, formerly manufactured by the company. Besides providing low voltage and either magnetic or thermal overload protection, the interlock provided permits replacement of contacts. The magnetic blowouts tend to reduce arcing to a minimum through powerful action. An extra-heavy magnet coil provides heavy sealing pressure, and the floating armature tends to eliminate magnetic hum. Self-aligning bearings and bronze bushings to reduce wear are included.

Prest-O-Lite Flood Light Attachment

Flood lighting of night work can be accomplished by the use of the portable attachment which has been announced by the Prest-O-Lite Company, Inc., 30 East 42nd St., New York, N. Y. It is intended for use with small tanks of dissolved acetylene such as are employed for truck and tractor lighting.

As shown in the illustration, the device is compact and of simple construction. A universal adjustment is obtained with one swing joint, thus minimizing the possibility of leakage. The attachment is placed near the vertical axis of the tank so that it may be used as handle. Only a single knurled nut holds the 10-in. reflector in place. An improved burner, which will not "carbon up," is placed at a fixed focal point and requires no adjustment.

Prest-O-Lite Flood Light Attachment

"Hercules" Socket Wrench Set

This set of heavy-duty socket wrenches made of "CV" chrome-vanadium steel has been introduced by the Bonney Forge & Tool Works, Allentown, Pa. It consists of 10 sockets, ranging in size from $\frac{13}{16}$- to $1\frac{5}{8}$-in. openings. As shown in the illustration, a ratchet handle, and a long and a short extension sliding T-handle are included. Each set is packed in a black-enameled sheet-steel carrying case.

"Hercules" Socket Wrench Set

Trade Catalogs

BUYERS' GUIDE FOR NICKEL ALLOY STEEL PRODUCTS. The International Nickel Co., Inc., 67 Wall St., New York, N. Y., has published a buyers' guide for nickel alloy steel products, dated July 1. The guide consists of a list of manufacturers and distributors of each product. A supplement gives the various types of nickel steels and their nickel content, together with the uses of each.

GENERAL ELECTRIC PUBLICATIONS. The General Electric Co., Schenectady, N. Y., has published a series of publications on various types of equipment. Bulletin 19E shows the type CR-7006-D4 and D-5 a.c. inclosed magnetic switches. This bulletin supersedes 19D. Catalog 874B, superseding 874A, shows type WD-200A arc welders in direct-motor or gas engine-driven types, either stationary or portable. Bulletin 723A, superseding in part 68033, shows coal and ore-bridge equipment for a.c. operation. Motors for bridge and trolley drives, braking and hoist drives are shown. Characteristics of the hoist motors are given in the form of curves. Catalog 1028 shows Form J, Class BU, totally-inclosed motors for use in explosive atmospheres. These are built in five types, the largest size being 10 horsepower.

HOISTS AND CRANES. The Harrington Co., 17th and Callowhill Sts., Philadelphia, Pa., has issued Catalog O on hand chain hoists, electric hoists, trolleys, and traveling cranes. Other items included are track and fittings, truck loaders, and winches. Photographs are used for illustrating the types and the methods of manufacture. Sizes and capacities of each type of equipment are given in tables. Part lists and photographs thereof permit easy selection of repair parts. Data on beams and channels, dimensions of crane rails, and the capacities of beams for various spans are given. The catalog contains 84 $10\frac{1}{2}$x8-in. pages.

LUBRICATING DEVICES. The Gits Bros. Manufacturing Co., 1940 So. Kilbourn Ave., Chicago, Ill., has published a supplement to Cat. No. 22. This supplement shows additional sizes of lubricating devices of plain and automatic feed, single- and multiple-types. General dimensions in inches are given.

POT FURNACES. The Sentry Co., Taunton, Mass., has issued Bulletin No. 1011 showing model L industrial electric pot furnaces designed for temperatures up to 1,600 deg. F. Specifications of the three sizes are given. The furnace is built with either alloy or steel pots. It is used for industrial production heat-treating in salt, lead and cyanide and for melting soft metals.

"TEXTOLITE" PRODUCTS. The General Electric Co., Schenectady, N. Y., has published Bulletin No. 937A, superseding 937, which shows various forms of "Textolite" in laminated and plastic molded types. This material is available in several compositions in the form of sheets, rods, strips, and tubing. Specifications of sheets and molded compounds are given.

Pamphlets Received

CALCULATING BEARING LOADS. The Strom Ball Bearing Manufacturing Co., 4535 Palmer St., Chicago, Ill., has published the second edition of Bulletin No. 1 entitled "Calculating Bearing Loads." The method of calculating bearing loads resulting from belt and rope drives, as well as chain, spur gear, helical gear, bevel gear, helical bevel gear, and worm gear drives are given. In each case, the system of forces acting upon the bearings is illustrated. The catalog, which is well printed and has clear illustrations, consists of 58 $7\frac{1}{4}$x$4\frac{1}{4}$-in. pages.

NEWS OF THE WEEK

Ford Employment Rises Above Record Peak

THE total number of Ford Model A cars now in consumers' hands is reported to be 275,000 with the 300,000 mark close by. Domestic assembly is averaging around 4,000 units per day, and including the Canadian production of 500 and assembly in other foreign branches, aggregate daily production now probably exceeds 5,000 units. In a recent statement, Henry Ford announced that his factory and assembly plants, which number more than 30, would be running at capacity by December 1.

Employment at the Ford plants, Detroit, is at a record high, totalling 120,293, against 115,837 on June 28, and in excess of the 110,000 peak employment during the manufacture of the Model T car. After discontinuing production of the Model T, employment dropped to a low point of 52,000 last summer. Fordson plant now employs 81,500, the Highland Park plant 34,900 and the Lincoln plant 3,900. So great is the number of workmen at the River Rouge plant, that several acres of land have been added to the parking space to accommodate workmen's automobiles.

It has been definitely decided to transfer the bulk of the work of the Cork plant, Ireland, to Manchester, England, it was announced at a meeting of the Cork Rotary Club. A large part of the newly-erected machinery has been taken to Manchester already. The decision to make the change was due to the fact that it had been found impossible to arrange a satisfactory solution of the difficulty imposed by the British duty of 22 2/9 per cent, which precluded the Ford car from competing in the English market.

Novel Mechanical Models Feature Exhibit

A novel exhibit of mechanical models is being held throughout the month of September at the Museums of the Peaceful Arts, 24 West 40th Street, New York. The exhibit is free to the public, and is designed to give a complete picture of the principal mechanical motions.

The first comprises 160 models, all operating under power and covering a wide range of mechanical motions and elements, showing different types of power transmission, quick return motions, gearing, pulleys, differential speed devices, ratchet movements, bearings, etc. Others show the workings of the devices of everyday life: the sewing machine, piano action, furnaces, hot water heaters, etc. Another section shows devices for handling water: turbines, propellers, etc. Other sections show the various elements of an automobile: the engine, starter, ignition, timer, differential, shifting mechanism, steering gear, etc. In another group there is the development of the steam engine, through the early trunk and oscillating engines, compound engines, etc., to modern steam turbines. The models are finished in color schemes and provided with legends to make the operating of each mechanism clear.

The second collection comprises 50 models operable by the visitor, giving a wide range of the elementary mechanical motions. This collection has been loaned by the Sheffield Scientific School of Yale University.

Personnel Is Announced for Foreign Commerce Committee

The Chamber of Commerce of the United States has announced the new Foreign Commerce Department Advisory Committee for the year 1928-1929. Charles W. Lonsdale, president, Simonds-Shields-Lonsdale Grain Co., of Kansas City, a member of the Chamber's board of directors and connected with other committees, will continue as chairman of the Foreign Commerce Committee during the coming year. Walter M. Daniel, member of the board of directors representing foreign commerce, and a director also of the American Chamber of Commerce in Cuba, will continue as vice chairman of the committee. Mr. Daniel is president of Daniel, Inc., of Havana. Henry D. Sharpe, president of Brown & Sharpe Manufacturing Co., Providence, former chairman of the committee, and member of the board of directors representing foreign commerce and at present chairman of the Civic Development Department Advisory Committee of the Chamber, will also continue as a member of the Foreign Commerce Committee.

The first meeting of the new committee will be at Hot Springs, Arkansas, on October 6, in connection with the Chamber's conference of national councillors and presidents and secretaries of organization members.

S.A.E. to Hold Aeronautic Meeting

During the National Air Races at Los Angeles the Society of Automotive Engineers will hold a two-day aeronautical meeting, Sept. 11 and 12, at the Los Angeles Biltmore. The morning of the first day will be devoted to discussions of passenger transportation. At the standards session in the afternoon there will be papers on the general subject of standardization by C. F. Clarkson, W. G. Naylor, and L. E. Lighton, and also a discussion of the present S.A.E. aeronautical standards. The night session will be given over to production problems. The Wednesday sessions will include papers on instruments and on design factors.

Shop Practice Division Convenes in Fall

The national machine shop practice meeting of the Machine Shop Practice Division, American Society of Mechanical Engineers, which will be held September 24 to 27 in Cincinnati, will be widely attended by engineers and executives interested in the use of machine tools. Arrangements include a special forum for the open discussion of problems arising in the use of machine tools, and for the exchange of experiences and comparison of notes.

The meeting is under the auspices of the Cincinnati section, with the machine tool congress co-operating. One of the features of the meeting will be a two-day trip by river steamer to visit the Ashland, Ky., plant of the American Rolling Mill Company.

Through the National Defense Division of the Society, all those attending the convention are invited by the Army Ordnance Association to attend its tenth annual meeting on Thursday, October 4, at the Aberdeen Proving Grounds.

Foremanship Conference Courses in Indianapolis

To develop and direct a systematic program of foreman training through regular foreman conferences in the plants of the Indianapolis members of the National Metal Trades Association and other interested metal trades shops, a three weeks' course of daily classes each afternoon for a period of two and one-half hours, will begin in Indianapolis October 15th, to train foreman conference leaders.

No cost is attached to these foreman conference leader development classes, and all Indianapolis companies employing metal trades operatives of any character and having eight or more foremen and department heads, are being invited by the association's educational committees in charge, to participate by sending one and not more than two picked company representatives. The classes will be conducted by A. R. Peirce.

The Business Barometer

The outlook in Commerce, Finance, Agriculture and Industry

By THEODORE H. PRICE

Editor, Commerce and Finance, New York

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Two highly significant news items whose implications seem to have been overlooked have been published recently. One was the statement issued by the Federal Reserve Board which showed that the amount of gold held by the central banks of the world had increased from $8,663,000,000 in 1924 to $9,733,000,000 in 1928. It is explained that, while this increase of $1,070,000,000, or about 12½ per cent, represents chiefly the excess of gold production over consumption in the arts, and absorption by India, it also includes gold acquired from private hoards as well as that which was formerly held as security for loans and has now been released for monetary use.

The other item is a description of the electrically-driven passenger vessel *Virginia*, lately launched at Newport News, with engines that deliver the equivalent of 185,724 "man-power," and never get tired.

These two factors—the increase in the world's fund of credit made possible by impounding its gold supply, and the increase in industrial production for which labor-saving machinery is responsible, are the most important economic influences presently at work, and the business optimism that persists, despite tight money, is probably due to a subconscious or unconscious recognition of their potency.

Because gold was in general circulation before the war, its effect upon the credit fund of which it is the base was less direct than it is now, when most of the world's gold supply is held by central banks, who use it mainly for the settlement of international balances.

Nominally, most of the commercial nations are now on a gold basis, but they have acquired the paper money habit. No one seems to want gold. The banks discourage its use for money, and as it is produced or released it flows naturally into the reserves which subtend the credit structure.

The confidence that there can be no money panic under these conditions and the gain in purchasing power made possible by labor-saving machinery have led people to persuade themselves that the present dislocation of the American money market will soon be adjusted.

Upon this theory, stocks are being bought and business is improving. Of course, it is possible that the theory may be wrong, or that its operation may be overdiscounted, but the ease with which the markets have withstood the high interest rates recently prevailing would seem to indicate that the position is essentially sound, and that a return to normal at an early date is highly probable.

Railroad earnings are increasing; distributive trade in merchandise appears to be improving; car loadings are approximating last year's figures; the steel industry continues to gain; building activity is unabated; and the textile trade is about the only dark spot on the commercial map of the country.

But even in textiles there are some indications of improvement, as a result of the curtailment in the production of cotton goods, and the effective work that the Wool Institute has accomplished. Signs that the price level is approaching an irreducible minimum are also noticeable on the exchanges where agricultural products are dealt in.

Farmers are commencing to hold their wheat. Old crop corn is somewhat firmer, and cotton is beginning to reflect the unfavorable crop reports that are coming from the fields; sugar has shown resistance in the face of conditions that are superficially bearish, while rubber and cocoa are the only commodities that have been really weak. The fact that they have been artificially supported for so long may explain this weakness, and should be a warning to the Brazilian friends of coffee who insist upon keeping it at a high price.

One reassuring phase of the situation is its insensibility to politics. No one seems to fear that a Republican or a Democratic victory will have the slightest effect on business, and no little satisfaction is felt in the fact that both parties are definitely committed to some solution of the farm problem.

"Coming events cast their shadows before," and it is quite possible that the hope of agricultural relief will strengthen the hands of the farmers in the efforts they are making to secure fair prices for this year's crops. If these efforts are even partially successful, the purchasing power of the agricultural states will be increased to the benefit of all concerned.

The "Anti-War Treaty" that was signed in Paris is another political factor whose psychological effect upon business cannot be ignored. Some 64 nations have signed or are expected to sign it and there can be no doubt of its constructive influence.

The per capita purchasing power of Europe, taken as a whole, is far below that of the United States, and if a prolonged period of peace should enable the whole world to catch up with America in production and consumption, the resulting increase in the world's trade would be amazing. It is the vision of such a possibility that is now inspiring many far-sighted investors, and even a partial realization of this vision will bring about an expansion that will fully justify the optimism of the optimistic. The only thing to be feared is that we may go too fast. If this error can be avoided, we ought to have a crescendo movement in our foreign and domestic trade during the autumn.

WHAT'S DOING IN INDUSTRY

CONFIDENCE is apparently quite general among machine tool dealers in most parts of the country. Little change is reported from last week. Ford has been increasing production steadily, and other companies are going ahead with programs of expansion. One of the largest machine tool builders in the East is busier than in a number of years in both its small tool and machinery divisions. Plants in New England making forgings, ball bearings and parts for the automotive industry are reported exceptionally active.

CANADIAN demand for machine tools continues to increase due to activity in practically all branches of the meal-working industry. Business is expected to be good throughout the remainder of the year. Dealers and distributors in Canada are expressing confidence in the present strength of the automotive market. New England buying has proceeded on a conservative basis, but has attained a momentum that is expected to continue indefinitely. Machinery sales in the New York district are still affected by the summer vacation season. Machine tool sales in the Southern district are comparatively steady, while the trend has been decidedly upward at Cincinnati.

INQUIRIES reached a satisfactory volume during the week, both the manufacturers and the selling agents reporting the receipt of well-diversified inquiries. Principal inquiries were from general machinists and miscellaneous users in almost all parts of the country. The prospects for heavy machine tools are improving in New York, although the railroads are not at present in the market to any extent.

The Industrial Review

Weekly progress of the machinery and machine tool business

THE following reports, gathered from the various machinery and machine tool centers of the country, indicate the trend of business in these industries and what may be expected from the future:

CINCINNATI

According to the majority of the machine tool manufacturers in the Cincinnati district the market trend has been upward during the past week. Almost all report an increase in their sales in the period and in no case is a falling off reported. The consensus is that the market will liven up considerably this month and that there will be a decided increase in the amount of business done.

Sales agents report a slight gain in the week. Heads of concerns in this branch of the trade predict that the market will improve gradually during the present month and express a feeling of encouragement.

An increased amount of business is reported to have come from the automobile industry and its allied trades, but the orders have been confined largely to single tools and replacements. In some instances it was stated that concerns in the allied trades had bought more than the automobile manufacturers. The backbone of the week's business, however, was the sale of single tools and replacements to general machinists and miscellaneous users. The week's orders came from all sections of the country and were well diversified in the matters of sizes and types of requirements.

Both the manufacturers and the selling agents report the receipt of a good volume of well-diversified inquiries in the week, scattered among which were a few lists. The principal inquirers were general machinists and miscellaneous users, located in all sections of the country.

Production is at a good level and there are many who express the opinion that there will be increased activity in the near future.

CANADA

A quickening of activity in practically every branch of the metal-working industry has resulted in a marked improvement in demand for machine tools in Canada during the last two weeks. With a bumper grain crop now a certainty there is little doubt but that business and industry generally throughout the Dominion will continue at a high level during the remainder of the year.

The outlook for the iron and steel industry is particularly promising. Demand for structural steel and reinforcing bars, on account of the heavy building activity prevailing all over the country, is vigorous and should be sustained over the fall and early winter. Inquiries are now apparent for last quarter iron and steel, and several buyers have booked small lots on immediate delivery for winter use. Production of steel ingots and direct steel castings at 82,807 tons in July was 50 per cent above the 55,250 tons reported for July of a year ago.

Warehouses report good business and splendid prospects ahead.

Prospects for the automobile industry during the remainder of the year are decidedly cheerful. Dealers and distributors are expressing confidence in the present strength of the automotive market. One manufacturer recently expressed the opinion that there was sound reason to believe that the present year would exceed all previous records for passenger car production.

In his review of the company's affairs during the fiscal year ended June 30, 1928, Robert J. Magor, president of the National Steel Car Corporation, stated that the volume of business produced during that period was approximately 27 per cent in excess of last year's production, about 10 per cent being accounted for by increased equipment orders, including not only standard equipment for the railroads, but also street cars and rolling stock of special design.

Canadian Vickers Company, Montreal, has just received an order from the Canadian Government to build a new 17-knot cruiser to be used in the Atlantic Division of the Customs preventive service. There were six tenders received, four of which were Canadian firms, and the bidding is understood to have been keen.

NEW ENGLAND

A consensus of opinions from representative machinery manufacturers and dealers in the New England territory points to a summer activity of unusual proportions. One dealer is doing his best summers' business in several seasons. A manufacturer of production and machine shop equipment, who had a dull summer in 1927, has been on full schedules without a let up since the first of May.

But buying has proceeded on a conservative basis. The usual rush to meet immediate requirements is being approached only a step at a time. The business momentum obtained in the machine tool industry, during the mid-summer, has been the result of cautious procedure, quite a remarkable fact considering the total volume of work in progress. It is the substantiated belief of leaders in the field that the favorable conditions, now evident, can and will continue indefinitely.

The current week, like its predecessor, showed a decline in the number of orders placed. Small machine units and lesser tool equipment comprised the reported volume of new business. Inquiries hold out the prediction that the fall months will see a continuation of full schedules in the metal-working industry. Prospective business from latest lists included a number of standard lathes, horizontal and vertical drills, automatic screw machines, grinding units, jig boring, die sinking, wire forming and riviting machinery. The electrical, steel, automotive, and household equipment manufacturers were represented.

NEW YORK

Sales of machinery in the New York district are still affected by the summer vacation season, but prospects for the fall are unusually bright. Several firms, however, report very good sales for the month of August, with inquiries equal to or ahead of July inquiries. Orders and inquiries are well distributed, showing no unusual situations. The prospects for heavy machine tools, which were moving only slowly during the first months of the year, are considerably improved although the railroads are not at present in the market. The only railroad inquiries mentioned during the week were for the New York Central.

The movement of ordinary second-hand machines is stated to be slow, but there is a ready market for modern machines in good condition. Machine shop accessories, grinding wheels, and small tools are moving regularly, but are also affected by the season. The General Electric continued in the market with some orders for standard machines. Some of the contract machine shops and small manufacturers of the New York area are reported exceptionally busy, but do not seem to be adding to their machine tool equipment. The new Lancia branch plant at Poughkeepsie is rumored to be about ready to buy equipment. The majority of dealers and agents report that inquiries throughout the district are good for all classes of machine tools, and that in view of business in prospect the year 1928 is likely to be considerably ahead of last year.

DETROIT

This is a period of unaccustomed activity for this time of the year, and though the orders for machinery and machine tools in the Detroit area are not coming in as rapidly now as they did a few weeks ago, the general business for August is still well above the average.

Most of the automobile companies and the manufacturers of parts and accessories are extraordinarily busy. The many changes in models and the unprecedented demand for cars has helped to stimulate the machinery and equipment business and the prospects for the immediate future are even better.

The body builders are, of course, all busy and the small shops are doing well. These shops are buying considerable replacement equipment and are making some extensions.

Among the motor car manufacturers whose sales make expansions and replacements more or less necessary are; Chrysler, Buick, Oakland, Studebaker, Graham-Paige, Reo, Willys-Overland, Cadillac, Chevrolet and others.

The Ford plant is making steady progress and is increasing its output every week. Chrysler is making many readjustments at Dodge and is making plans for big production of Chrysler, Plymouth and DeSoto cars all of which are in demand. The Chrysler-Dodge situation is one of the most promising in the district, not only for the future of the automobile business and the consequent benefit to the machinery trade, but to general business as well.

Employment here continues to gain rapidly. Week before last the gain was more than 7,000 and this week it will be above the average gain of 3,000 that has been maintained through every week of the year. General business conditions here are remarkably good.

SOUTHERN DISTRICT

Though most dealers and distributors report machinery and machine tool sales in the southeastern territory comparatively steady, there has been little change the past two weeks, business slightly less than it was at this time last season, with the outlook for fall promising about a normal volume. The fact that business is a little less than last year does not mean it is below normal, for at this time in 1927 sales were beginning to open up on a very active basis, which later resulted in one of the best fall seasons in some years.

The late summer finds the garages and service stations buying on a little better basis than they were, though as has been the case all this year their purchases run mainly to used or rebuilt equipment. Demand from the smaller machine shops continues quiet, and there is little prospect that there will be any improvement in the near future.

Railroads continue to place a few scat-

tered orders for heavier equipment for various shop projects in the Southeast, but are not as active as they were a few weeks ago. Textile mills continue buying on a good basis, and as there are still a number of new mills under construction in the Southeast dealers look for this business to continue fairly active for the next several weeks. In this section textile business has been unusually good ever since the first of the year.

A gradual decline is reported in the demand for woodworking machinery, and though some fair sales are still being reported by dealers to furniture plants in the Georgia, Carolina and East Tennessee district, other branches of the industry are quiet, with about normal demand looked for during the late summer and fall months. Construction machinery and road building equipment also is less active.

Engineers Urge Modernization of Farm Equipment

Efficiency and economy in the manufacture and operation of farm machinery, with new designs incorporating the best in bearings and materials to resist shock and wear, was brought out as one of the high lights at the summer convention of the American Society of Mechanical Engineers in St. Paul and Minneapolis August 27-30. The trend in farm equipment is towards labor-saving machinery, it was brought out, and farmers are more ready to accept new devices.

Special sessions also included discussions on applied mechanics, apprenticeship programs, aeronautics and the future trends in aviation, fuels and materials handling and the mechanization of agriculture. A number of interesting inspection trips had been arranged in the convention cities and in Duluth and Winnipeg.

Railway Tool Foremen's Program Completed

Topics covering the most important problems confronted in the toolroom will be discussed at the sixteenth annual convention of the American Railway Tool Foremen's Association, which will be held at the Sherman Hotel, Chicago, Ill., September 12, 13 and 14. The opening address will be given by P. Kass, superintendent of the car department of the Chicago, Rock Island & Pacific, who will discuss tools and equipment required by the car department, pointing out the relationship of the toolroom to this branch of work.

D. C. Curtis, chief purchasing officer of the Chicago, Milwaukee & St. Paul R.R., will talk on the relation of the purchasing department to the toolroom, the benefit derived from standardization, and suggestions as to future standardization. Mr. Curtis has devoted considerable time to standardization work.

The committee assigned to the various topics to be treated has submitted reports that will be of educational value to the attending representatives and of benefit to the railroad towards establishing efficient tool service. The topics are as follows: "The Proper Heat Treatment of Steel;" "Standardization of Boiler Tools;" "Jigs and Devices for the Locomotive Shop;" and "Rake and Clearance of Machine Tools."

The supply division of the association has arranged an exhibit of tools and repair appliances which will be a somewhat larger display than heretofore, featuring many forms of modern labor saving devices. From the assurance received from mechanical offices of various railroads, a large attendance is expected. Representatives from all railways are invited.

To Finance Enterprises in Foreign Countries

Paul H. Petersen, now president of Paul H. Petersen, Inc., New York City, who has been associated for a number of years with Jos. T. Ryerson as export manager, advises that his firm, which is sole export agent for several machine tool builders including Jos. T. Ryerson & Son, Inc., Chas. F. Elmes Engineering Works, the Vaughn Machinery Co., Milwaukee Electric Crane & Manufacturing Co., and the Curtis & Curtis Co., is now undertaking to provide all necessary funds to finance enterprises in foreign countries all over the world.

Paul H. Petersen, Inc., will co-operate with American manufacturers in selling equipment to foreign countries and will finance long term credits, thus assisting both the manufacturer in selling, and, the purchaser in buying the equipment he may need.

They will also undertake, wherever found desirable, the complete installation and operation of entire manufacturing plants of the lines which they handle. Complete designs of plants will be undertaken, including the management of such plants. Assistance will be given to those having factories already in operation, but who need capital and modernizing of their equipment in order to increase production and reduce manufacturing costs.

Russian Manufacturers Here to Purchase Machinery

Saul Bron, chairman of the Amtorg Corporation, the organization through which trade between Russia and America is conducted, arrived in New York on August 30 aboard the *Mauretania* with a group of Russian business men. This commission, which is reported as prepared to spend $40,000,000 for automobile trucks, farm tractors and oil refining machinery, is headed by Mr. Bron and includes M. Sorokin, president of the Russian Automobile Manufacturers Association; I. Chalepsky, a leading industrialist in the Soviet, and M. Rogoff, vice-mayor of Moscow.

Mr. Bron revealed that for the year ending October 1 business between the Russian Soviet and the United States would reach $128,000,000 almost all of which represented goods exported by this country. This is $48,000,000 above that placed during the preceding year.

The Russians, said Mr. Bron, were not buying pleasure cars, because they were a burden for their pocketbooks. For farm machinery, however, the Soviets are willing to make great outlays, finding the modernizing of agriculture a help to the stabilization of the government, according to Mr. Bron. Besides the tractors and trucks, the Amtorg Corporation will buy large quantities of machinery for their manufacture. It was said by the commission that the Soviet hoped to be self-dependent in farm machinery and as an aid in this several hundred technical workers, familiar with American methods of manufacture and management, might be taken back to Russia to organize the automotive industry there.

The stay of the commission will be indefinite. Before purchases are made Mr. Bron and the others will visit the Ford and General Motors plants, as well as others throughout the country.

Largest Locomotive Order Awarded

An order for the construction of 55 large engines and 5 additional 15,000 gallon tenders, involving an expenditure of $5,400,000, has been awarded to the American Locomotive Co. by the New York Central Railroad. This is the largest order for motive power placed this year, exceeding a previous order placed by the Erie, in May, for 35 engines.

Thirty of the engines will be of the latest design passenger type, known as the Hudson, weighing 175 tons each, and 25 will be of the Mohawk type freight engine, weighing 182 tons each.

New Trade Commissioner Appointed

John J. Ehrhardt, of Jersey City, N. J., was recently appointed Trade Commissioner at Tientsin, China, by Dr. Julius Klein, director, Bureau of Foreign and Domestic Commerce. Mr. Ehrhardt is a graduate of Stevens Institute of Technology and is an experienced mechanical engineer.

Trade Commissioner Ehrhardt is now conferring with business men interested in Chinese trade, and sails from Seattle on Sept. 8. The Tientsin office is expected to be opened in November.

Diamond Chain Company to Expand Plant

The Diamond Chain and Manufacturing Co., of Indianapolis, Ind., has completed plans and placed contracts for a large additional factory unit, four stories high, that will add 40,000 sq.ft. of floor space to its plant. Reinforced fireproof concrete construction, similar to the present plant, will be employed. The additional capacity has been made necessary because of the greater use of Diamond chain, particularly the high-

speed power type. The production of timing chains for motor cars also has increased to the point where additional manufacturing space is required for this department.

Personals

COMMANDER J. C. HUNSAKER, formerly chief of the design division of the Bureau of Aeronautics, has been made vice-president of the Goodyear-Zeppelin Corporation.

WILLIAM ALLES, assistant works manager of Dodge Brothers, Inc., has left the employ of the company and will take an extended vacation before making another connection.

RICHARD S. TWITCHELL, consulting engineer, of Boston, Mass., has been elected executive secretary of the Affiliated Technical Societies of Boston to succeed Prof. John B. Babcock, who recently resigned.

LOUIS K. LIGGETT, chairman of the Board of Directors of the Winchester Repeating Arms Co., New Haven, Conn., was elected chairman of the Executive Committee to succeed Frank G. Drew, who becomes president of the board.

HANS RASMUSSEN, of the Zschopauer Motorenwerke, Zschopau, Germany, returned home August 31 on the S. S. *Dresden*, after a five months visit to the United States, during which he saw most of the important automobile plants.

C. H. TEMPLE, chief of motive power and rolling stock of the Canadian Pacific Railway, has retired from active service after having been identified with railroad work in Canada for nearly fifty years. He joined the C.P.R. in 1886 and has held various positions in the mechanical department.

J. D. MUIR has been appointed assistant superintendent of motive power of the Canadian Pacific Railway. Mr. Muir has been in the employ of the C.P.R. for 23 years. At the time of his recent promotion he was general foreman of the Angus shops at Montreal.

GEORGE H. WILCOX, president of the International Silver Company, Meriden, Conn., has resigned and will continue with the company as chairman of the Board of Directors. Clifford R. Gardiner has been elected president to succeed Mr. Wilcox. Mr. Gardiner has been purchasing agent for the company. At the same time Evarts C. Stevens was elected a director to fill the vacancy caused by the death of George D. Munson.

THORSTEN Y. OLSEN, vice-president and treasurer of the Tinius Olsen Testing Machine Co., of Philadelphia, sailed recently for Norway to attend the unveiling of a monument erected in honor of his father, Tinius Olsen, in his home town of Kongsberg. It has been erected in recognition of his engineering work and accomplishments as well as for his interest in the furtherance of the Kongsberg Technical Evening School.

Obituaries

JOHN E. JOHNSON, treasurer of the D. & J. Machine Co., Worcester, Mass., died suddenly on August 30 in Toronto while touring with his wife and two sons.

ERNEST J. BOSSERT, sole proprietor of the Bossert Machine Co., Cincinnati, manufacturers of machine tools and special machinery, died on August 27. He was fifty-nine years old, and had been engaged in the machinery business for more than twenty years.

GEORGE F. SIMPSON, for many years president of the J. F. & G. F. Simpson Iron Foundry, Brooklyn, N. Y., died on August 29 of heart disease at the Lock Arbor Hotel, Allenhurst, N. J. Mr. Simpson was 78 years old, and is said to have been the oldest living member of Sigma Phi.

Business Items

The Haynes Corporation, of Chicago, has announced the appointment of W. H. Frazier, of Cincinnati, to direct the activities of its branch sales office in St. Louis.

Western Steel Products, Ltd., of Winnipeg, Manitoba, are preparing to expand their business. Additional land has been purchased at Winnipeg, Regina, Saskatoon, Calgary and Edmonton for further extensions to plant.

The Ideal Commutator Dresser Co. of Sycamore, Ill., is now represented in the Rocky Mountain district by the Industrial Supply Co., of Salt Lake City, Utah, for the sale of commutator and motor maintenance equipment.

The Torrington Co. of Maine, which controls the Torrington Co. of Connecticut, is proposing to reduce its capitalization from $11,000,000 to $7,000,000 by the retirement of 40,000 shares of preferred and 120,000 of its un-issued common stock.

The Collingwood Steel Corporation, of Collingwood, Ontario, organized to operate the plant formerly occupied by the Imperial Steel Corporation, is expected to start production Oct. 1. Wire and nails will be the initial products, with other items to be added later.

R. Hoe & Co., Inc., manufacturer of printing machinery, expects to offer its Class A stockholders $800,000 worth of 7 per cent notes, and 16,000 additional Class A shares, for every ten shares held. The money thus raised is to be used in financing a new plant in the Bronx.

Announcement has been made by the Davis Boring Tool Co., St. Louis, Mo., that it has moved its plant to 6200 Maypole Ave., and the new location will house the general offices as well as the manufacturing department. Manufacturing facilities have been increased considerably.

The Air Reduction Co., Inc., purchased on August 1 the business and property of the Ohio Oxygen Co., Niles, Ohio. The purchase of this plant makes thirty-seven oxygen plants whose production and sales are controlled by the Air Reduction Co., Inc., and the Air Reduction Sales Company.

Announcement is made that the Kaester & Hecht Co. will now be known as the Westinghouse Electric Elevator Co., and that the headquarters and plant of the new company will be located in Chicago. The company has been in the elevator business for many years, and in 1926 went under the control of the Westinghouse Electric & Manufacturing Company.

The Chevrolet Motor Co., which recently opened its new southeastern plant in Atlanta, has awarded contracts for the construction of a $150,000 building at New Orleans, La., to be used as a parts distribution plant by the company for the handling of its dealer trade in parts of the southeastern territory, it is announced by officials of the southern branch in Atlanta.

The Lukens Steel Co., Coatesville, Pa., manufacturers of plates, flanged and dished boiler heads, etc., will open a new southeastern branch in Atlanta within the next few weeks, it has been announced by the Industrial Bureau of the Atlanta Chamber of Commerce. Adolph Rider, Jr., identified with the company for several years, will be manager in charge of the district, which will cover the group of southeastern states.

The Chance Co., Centralia, Mo., manufacturers of patent anchors, pole line equipment specialties, etc., sold largely to public utility concerns, has announced that a new office is being opened by the company in Atlanta at 1104 Candler Bldg., to handle the company's trade in the group of nine southeastern states. Alfred C. Wilson, southern representative of the company, has been named manager of the new branch.

The Bridgeport Airport, Inc., Bridgeport, Conn., held their annual meeting recently and elected eight new directors as follows: Walter B. Lashar, president of the American Chain Co.; DeVer H. Warner, chairman of the Board of Directors, Warner Brothers Company; Sumner Simpson, president of the Rayhestos Co.; Gilbert W. Goodridge, Samuel P. Senior, Edmund S. Wolfe, Sylvanus D. Locke and Julius H. Siebert. Seven other directors were re-elected.

Forthcoming Meetings

Canada's Steel and Power Show. Second annual show to be held at the University of Toronto Arena, Sept. 4-7. Secretary, Campbell Bradshaw, 24 Front St., Toronto, Ontario.

American Railway Tool Foremen's Association. Annual meeting, Hotel Sherman, Chicago, Sept. 12, 13 and 14. G. G. Macina, secretary, 11402 Calumet Ave., Chicago.

American Railway Tool Foreman's Association. Sixteenth annual convention of the Supply Association. Hotel Sherman, Chicago, Sept. 12, 13 and 14. F. A. Armstrong, secretary, the Pratt & Whitney Co., 564 W. Monroe St., Chicago.

Machine Shop Practice Division, American Society of Mechanical Engineers. National meeting, Cincinnati, Sept. 24-26. Part of sessions to be on steamer "Cincinnati." Secretary, Carlos de Zafra, 29 W. 39th St., New York City.

American Society of Mechanical Engineers. Boston Regional meeting, Oct. 1-3. C. E. Davies, secretary, 29 W. 39th St., New York City.

National Safety Council. Seventeenth annual safety congress to be held in New York, October 1-5. W. H. Cameron, managing director, 108 E. Ohio St., Chicago.

American Society for Steel Treating. "National Metals Exposition," Commercial Museum, Philadelphia, Pa., week of Oct. 8. W. H. Eisenman, secretary, 4600 Prospect Ave., Cleveland, Ohio.

American Welding Society. Fall meeting and exposition, Exhibition Hall of Commercial Museum, Philadelphia, Pa., Oct. 8-12, in conjunction with "National Metals Exposition" of the American Society for Steel Treating. Miss M. M. Kelly, secretary, 29 West 39th St., New York City.

Institute of Metals, Division of American Institute of Mining and Metallurgical Engineers. Annual fall meeting during National Metal Week, Oct. 8-12, Benjamin Franklin Hotel, Philadelphia. W. M. Corse, secretary, 810 18th St., N. W., Washington, D. C.

American Gear Manufacturers' Association. Semi-annual meeting, including joint session with the Machine Shop Practice Division of the American Society of Mechanical Engineers, Statler Hotel, Buffalo, N. Y., Oct. 11-13. T. W. Owen, secretary, 3608 Euclid Ave., Cleveland, Ohio.

Society of Industrial Engineers. Fifteenth annual convention, Rochester, N. Y., October 17-19, in conjunction with the Industrial Management Council of the Rochester Chamber of Commerce. George C. Dent, executive secretary, 205 Wacker Drive, Chicago.

National Manufacturers' Association. Combined assembly with the National Industrial Council in New York City, October 22-24. George S. Doudinot, secretary, 11 W. 42nd St., New York City.

American Management Association. Autumn convention, Palmer House, Chicago, Nov. 13-15. W. J. Donald, managing director, 20 Vesey St., New York City.

Iron and Steel Division, American Society of Mechanical Engineers. Second national meeting, Chicago, November 14-15. Thomas Wilson, chairman of Chicago local section host, 7 S. Dearborn St., Chicago.

American Society of Mechanical Engineers. Annual meeting, Engineering Societies Bldg., New York, week of Dec. 3. Calvin W. Rice, secretary, 29 W. 39th St., New York City.

The Weekly Price Guide

Rise and Fall of the Market

SUCH changes as occurred in prices of shop materials and supplies during the week were all in an upward direction. Pig iron and steel are notably firm, with demand in the latter particularly active in pipe, structurals, reinforcing material and mesh. Non-ferrous metals hold also a strong position as to price. This firmness extends to scrap, which rose at New York and Chicago in several descriptions. Iron and steel scrap buying is slow, most of the mills having heavy supplies at hand.

(All prices as of Aug. 31, 1928)

IRON AND STEEL

PIG IRON—Per gross ton, f.o.b.:

CINCINNATI	
No. 2 Southern	$19.69
Northern Basic	20.89
Southern Ohio No. 2	21.19
NEW YORK—Tidewater Delivery	
Southern No. 2 (silicon 2.25@2.75)	25.62
BIRMINGHAM	
No. 2 Foundry	16.25
PHILADELPHIA	
Eastern Pa., No. 2x (silicon 2.25@2.75)	20.76
Virginia No. 2	27.17
Basic	19.76
CHICAGO	
No. 2 Foundry local (silicon 1.75@2.25)	20.00
No. 2 Foundry, Southern (silicon 2.25@2.75)	22.01
PITTSBURGH, including freight charge ($1.76) from Valley:	
No. 2 Foundry	19.26
Basic	19.26
Bessemer	21.26

IRON MACHINERY CASTINGS—Cost in cents per lb. of 100 flywheels, 6-in. face x 24-in. dia., hub not cored, good quality gray iron, weight 275 lb.:

Detroit	4 50
Cleveland	5.00
Cincinnati	4.30
New York	5.25
Chicago	4.50@4.75

SHEETS—Quotations are in cents per pound in various cities from warehouse; also the mill base in large lots.

Blue Annealed	Pittsburgh Mill Base	Chicago	Cleveland	New York
No. 10	2.10@2.20	3.35	3.25	3.90*
No. 12	2.15@2.25	3.40	3.30	3.95*
No. 14	2.25@2.35	3.45	3.35	4.00*
No. 16	2.35@2.45	3.55	3.45	4.10*
Black				
Nos. 18 to 20	2.40@2.45	3.60	3.20	4.00
No. 22	2.55@2.60	3.75	3.35	4.15
No. 24	2.60@2.65	3.80	3.40	4.20
No. 26	2.70@2.75	3.90	3.50	4.30
No. 28	2.85@2.90	4.05	3.65	4.45
Galvanized				
No. 10	2.70@2.90	3.95	3.55	4.25
Nos. 12 to 14	2.80@3.00	4.05	3.65	4.35
No. 16	2.90@3.10	4.15	3.75	4.45
No. 18	3.05@3.25	4.30	3.90	4.60
No. 20	3.20@3.40	4.45	4.10	4.75
No. 22	3.25@3.45	4.50	4.15	4.80
No. 24	3.40@3.60	4.65	4.25	4.95
No. 26	3.65@3.85	4.90	4.50	5.20
No. 28	3.90@4.10	5.15	4.75	5.45

*250 to 3,999 lb.

WELDED STEEL PIPE—Warehouse discounts are as follows:

	New York Black	New York Galv.	Cleveland Black	Cleveland Galv.	Chicago Black	Chicago Galv.
1 to 3 in., butt welded	50%	36%	55½%	43½%	54%	41%
2½ to 6 in., lap welded	45%	32%	53½%	40½%	51%	38%

WROUGHT-STEEL PIPE LIST

Size, Inches	List Price per Foot	Diameter in Inches—External	Diameter in Inches—Internal	Thickness Inches
1	$0.17	1.315	1.049	.133
1¼	.23	1.66	1.38	.14
1½	.27½	1.9	1.61	.145
2	.37	2.375	2.067	.154
2½	.58½	2.875	2.469	.203
3	.76½	3.5	3.068	.216
3½	.92	4.0	3.548	.226
4	1.09	4.5	4.026	.237
4½	1.27	5.0	4.506	.247
5	1.48	5.563	5.047	.258
6	1.92	6.625	6.065	.28

SEAMLESS STEEL TUBING—Following net prices are for seamless mechanical tubing, cold drawn, round, .10 to .30 carbon, at New York warehouse in lots of less than 100 ft. or 100 lb.:

Thickness—Decimal	B.w.g. and Fractions	Outside Diameter in Inches—¼	⅜	½	⅝	1	1⅛	1¼
		Price per Foot						
.035″	20	$0.15	$0.16	$0.17	$0.18	$0.19	$0.21	$0.23
.049″	18	.17	.18	.19	.20	.21	.23	.25
.065″	16	.19	.20	.21	.22	.23	.25	.27
.083″	14	.20	.22	.23	.24	.25	.27	.29
.095″	13	.21	.23	.25	.26	.27	.29	.31
.109″	12	.22	.24	.26	.27	.28	.30	.32
.120″ or .125″	11	.23	.25	.27	.28	.29	.31	.33
.134″	10	.24	.26	.28	.29	.30	.32	.34

MISCELLANEOUS—Warehouse base prices in cents per lb.:

	New York	Cleveland	Chicago
Spring steel, light*	4.50	4.65	4.65
Spring steel, heavier	4.00	4.00	4.00
Coppered Bessemer rods	6.05	6.00	6.20
Hoop steel	4.50‡	4.00	4.15
Cold rolled strip steel	6.25	6.00	6.10
Floor plates	5.10‡	5.30	5.00
Cold drawn, round or hexagon†	3.40	3.65	3.60
Cold drawn, flat or square†	3.90	4.15	4.10
Structural shapes	3.30‡	3.00	3.10
Soft steel bars	3.25‡	3.00	3.00
Soft steel bar shapes	3.25‡	3.00	3.00
Soft steel bands	4.00‡	3.65	3.65
Tank plates	3.30‡	3.00	3.10
Bar iron (2.75 at mill)	3.24	3.00	3.00
Drill rod (from list)	60%	55%	50%

*Flat, 3/16@½-in. thick. †Cold finished steel, shafting and screw stock. ‡250 to 3,999 lb., ordered and released for shipment at one time.

Electric welding wire, New York, 3/32, 8.35c.; ⅛, 7.85c.; 5/32 to ¼ 7.35c. per lb.

METALS

Warehouse Prices in Cents Per Pound for Small Lots:

Copper, electrolytic, New York			15.50
Tin, Straits, pigs, New York			51.00
Lead, pigs, E. St. Louis	6.22½	New York	7.75
Zinc, slabs, E. St. Louis	6.25	New York	7.75

	New York	Cleveland	Chicago
Antimony, slabs	13.00	13.00	14.25
Copper sheets, base	23.50	23.50	23.50
Copper wire, base	20.12½	19.62½	16.75*
Copper bars, base	22.00	22.00	22.50
Copper tubing, base	25.00	25.00	25.00
Brass sheets, high, base	19.25	19.25	19.25
Brass tubing, high, base	24.12½	24.12½	24.12½
Brass rods, high, base	17.00	17.00	17.00
Brass wire, high, base	19.75	19.75	19.75

*At mill

Shop Materials and Supplies

METALS—Continued

	New York	Cleveland	Chicago
Aluminum ingots, 99%.....	25.00*	24.30	24.30
Zinc sheets (casks).....	10.00@10.50	11.00	9.61
Solder (strictly).....	32.25	30.75	31@34

Babbitt metal, delivered in case lots, New York, cents per lb.:

Genuine, highest grade.....	67.75
Commercial genuine, intermediate grade.....	53.00
Anti-friction metal, general service.....	31.50
No. 4 babbitt (f.o.b.).....	12.25

Nickel, f.o.b. refinery, Bayonne, N. J., cents per lb.:

Ingots.....	35.00	Electrolytic.. 37.00	Shot..... 36.00

*Delivered.

SPECIAL NICKEL AND ALLOYS—Price in cents per lb., f.o.b. Huntington, W. Va.:

Full finished nickel sheet (base).....	52.00
Cold rolled nickel sheet (base).....	60.00
Hot rolled rods, Grade "A" (base).....	45.00
Cold drawn rods, Grade "A" (base).....	53.00

Base price of Monel metal in cents per lb., f.o.b. Huntington, W. Va.:

Shot.....	28.00	Hot rolled rods (base)...	35.00
Blocks.....	28.00	Cold drawn rods (base)..	43.00
Cold rolled sheets (base)	50.00	Full finished sheets (base)	42.00

OLD METALS—Dealers' purchasing prices in cents per pound, f. o. b. cars, depending on quantity:

	New York	Cleveland	Chicago
Crucible copper.....	12.75 @13.00	12.00	11.75@12.25
Copper, heavy, and wire..	12.00 @12.75	11.25	11.25@11.75
Copper, light, and bottoms	10.87½@11.12½	9.75	10.00@10.50
Heavy lead.....	5.00 @ 5.25	5.25	4.75@ 5.25
Tea lead.....	3.50 @ 3.75	3.75	3.75@ 4.25
Brass, heavy, yellow.....	7.25 @ 7.50	7.75	7.25@ 7.75
Brass, heavy, red.....	10.00 @10.37½	10.00	9.50@ 9.75
Brass, light.....	5.75 @ 6.00	6.25	6.25@ 6.75
No. 1 yellow rod turnings.	8.00 @ 8.37½	7.75	7.75@ 8.25
Zinc.....	3.25 @ 3.50	3.25	2.87½@3.37½

TIN PLATES—Charcoal—Bright—Per box.

		New York	Cleveland	Chicago
"AAA" Grade:				
IC,	14x20.....	$12.10	$11.95	$11.50
"A" Grade:				
IC,	14x20.....	9.70	9.90	9.50
	Coke Plates—Primes—Per box			
100-lb.,	14x20.....	6.45	6.10	7.00
	Terne Plates—8-lb. Coating—Small lots—Per box			
IC,	14x20.....	7.75@8.00	7.00	7.50

MISCELLANEOUS

	New York	Cleveland	Chicago
Cotton waste, white, per lb.*	$0.10@0.13½	$0.16	$0.15
Cotton waste, colored, per lb.*	.09@ .13	.12	.12
Wiping cloths, washed white, per lb.....	.15½	38.00 per M	.17
Sal soda, per lb.....	.02	.02	.02
Roll sulphur, per lb.....	.027	.03½	.04
Linseed oil, raw, in 1 to 4 bbl. lots, per lb.....	.105	.105	.103
Cutting oil, about 25% lard, in 5 gal. cans, per gal....	.65	.60	.60
Machine oil, medium-bodied (55 gal. steel bbl.) per gal.....	.30	.36	.36
Belting—Present discounts from list in fair quantities (½ doz. rolls).			
Leather—List price, 24c. per lin.ft. per inch of width for single ply.:			
Medium grade.....	30–10%	30–10%	35%
Heavy grade.....	25–5%	30–5%	30%
Rubber transmission, 6-in., 6 ply, $1.83 per lin.ft.:			
First grade.....	50%	50–10%	50%
Second grade.....	60%	60–5%	50–10%

*All waste in bale lots.

Comparative Warehouse Prices

New York	Unit	Current Price	Four Weeks Ago	One Year Ago
Soft steel bars.....	per lb....	$0.0325	$0.0325	$0.0324
Cold drawn shafting....	per lb....	.034	.034	.04
Brass rods.....	per lb....	.17	.17	.16
Solder (½ and ½).....	per lb....	.3225	.31	.40
Cotton waste, white....	per lb....	.10@.13½	.10@.13½	.10@.13½
Emery disks, cloth, No. 1, 6-in. dia.....	per 100...	3.10	3.10	3.10
Lard cutting oil.....	per gal...	.65	.65	.65
Machine oil.....	per gal...	.30	.30	.27
Belting, leather, medium.....	off list....	30–10%	30–10%	40–5%
Machine bolts, up to 1x30 in., full kegs....	off list....	50%*	50%*	50%*

*List prices as of April 1, 1927.

MISCELLANEOUS—Continued

	New York	Cleveland	Chicago
Abrasive materials—Standard grade, in sheets 9x11 in., No. 1, per ream of 480 sheets:			
*Flint paper.....	$5.40	$5.56	$5.13
*Emery paper.....	10.71	11.90	10.71
†Emery cloth.....	27.84	27.85	27.84
Emery disks, 6 in. dia., No. 1, per 100:			
Paper.....	1.29	1.45	1.32
Cloth.....	3.10	3.55	3.05
Fire clay, per 100 lb. bag.....	1.00	.75	.75
Coke, prompt furnace, per net ton...	Connellsville,		2.75@3.00
Coke, prompt foundry, per net ton..	Connellsville,		4.00@4.50
White lead, dry or in oil...	100 lb. kegs....	New York,	13.25
Red lead, dry.....	100 lb. kegs....	New York,	13.25
Red lead, in oil.....	100 lb. kegs....	New York,	14.75

*4½ reams and under. †Less than 2 reams.

SHOP SUPPLIES

Discounts from new list dated Apr. 1, 1927, applying on immediate deliveries from warehouse stocks in New York and vicinity:

	Full Kegs or Cases
Machine bolts, square heads and nuts:	
Up to ¾ x 6-in.....	55%
Larger up to 1 x 30-in.....	50%
1¼ and 1½ in. dia.....	35%
Carriage bolts:	
Up to ½ x 6-in.....	55%
Larger sizes.....	50%
Coach and lag screws:	
Up to ½ x 6-in.....	55%
Larger sizes.....	50%
Tap bolts, hexagonal heads.....	40%
Nuts:	
Hot pressed, square and hexagonal, blank or tapped, up to 1-in., incl.....	55%
Cold punched, square and hexagonal, blank or tapped, up to 1-in. incl.....	55%
Semi-finished, hexagonal, tapped, in packages, all sizes.....	40%
Case hardened, hexagonal, tapped, in packages, all sizes.....	30%
Washers: Deduct from list, per 100 lb.....	$3.50*
Rivets, button and cone head:	
Small, including ½-in. dia.....	50–10%
Large (base) per 100 lb. net.....	$5.00†

Note—For less than full package quantities on bolts, screws, hot-pressed and cold-punched nuts, add extra of 10 per cent to list.
*Broken keg lots, $1.50 off list. †Broken keg lots, $6.50 net.

Machine Requirements and Industrial Construction

Equipment Wanted

D. C., Washington—A. L. Flint, General Purchasing Officer of the Panama Canal, will receive bids until Sept. 11 for portable pneumatic grinder, band saws, dies, air compressor, etc.

Mich., Flint—Chevrolet Motors Co., General Motors Bldg., Detroit—machinery and equipment for proposed 1 story, 205 x 315 ft. machine shop on West Kearsley St. here.

Mich., Lansing—Olds Motor Works, Division St.—crane and conveyors for proposed 1 story, 40 x 200 ft. enameling plant. Estimated cost $50,000.

Mo., Webb City—O. W. Dunham—lathes, drill press, band saw, jointer, bench tools, sander, etc.

Pa., Bethlehem—Lehigh University—10 ton overhead electric crane, 18 ft. span for laboratory.

Opportunities for Future Business

Calif., Emeryville—Western Electric Co., 680 Folsom St., San Francisco, is having plans prepared for a 5 story factory here. Estimated cost $500,000. Private plans. Noted July 19.

Colo., Denver—Public Service Co. of Colorado, C. W. Stannard, V. Pres. and Gen. Mgr., 15th and Champa Sts., awarded contract for the construction of a 2 story service building and warehouse at Lipan and Mariposa Sts. and West Third and Fourth Aves., also for garage on West Third Ave. between Lipan and Mariposa Sts. Total cost $530,000.

Conn., Hartford—M. S. Little Mfg. Co., 151 New Park Ave., awarded contract for the construction of a 1 story, 50 x 120 ft. brass foundry. Estimated cost $40,000. Noted Aug. 23.

Conn., Waterford—Connecticut Power Co., 33 Union St., New London, is having plans prepared for the construction of a 3 story, 75 x 210 ft. service building here. Estimated cost $200,000. L. H. Goddard, 85 State St., New London, Archt.

D. C., Washington — International Harvester Co., 606 South Michigan Ave., Chicago, Ill., awarded contract for a 1 story motor truck factory, service and repair works on Bladensburg Rd. E. here. Estimated cost including equipment. $100,000.

Ill., Chicago—Nordenberg Trunk Works, 406-8 North Clark St., manufacturers of metal trunks, etc., plans rebuilding portion of plant recently destroyed by fire. Estimated cost including equipment $50,000.

Ind., Fort Wayne—Poinsatte Bros., 323 East Washington St., is having plans prepared for a 1 story, 60 x 150 ft. machine shop and service building. Estimated cost $50,000. Pohlmeyer & Pohlmeyer, 260 Central Bldg., Archts.

Ind., Indianapolis—A. J. Lauth, 3169 Washington Blvd., is receiving bids for a 1 story, 154 x 170 ft. machine shop and service building, etc., at East Washington St. and Brookville Rd. Estimated cost $85,000. Deoppers & Lennox, 226 East Michigan St., Archts. Chevrolet Co., 3909 East Washington St., lessee.

Ind., South Bend—Bike Web Co., awarded contract for the construction of a 2 story, 100 x 220 ft. factory. Estimated cost $78,000.

La., New Orleans—New Orleans Parish School Board, City Hall, will receive bids until Sept. 14 for the construction of a 3 story school, including manual training shop, etc., on St. Claude St. Estimated cost $250,000. E. A. Christy, City Hall, Archt.

Mass., Cambridge (Boston P.O.)—Cambridge Salvage & Supply Co., 91 Broadway, awarded contract for a 1 story, 125 x 150 ft. factory at Charles, Bent and Fifth Sts. Estimated cost $60,000. Noted Apr. 19.

Mass., Cambridge (Boston P.O.)—Massachusetts Institute of Technology, Massachusetts Ave., is receiving bids for a 1 story, 85 x 155 ft. engine testing laboratory and shop at Vassar St. and Massachusetts Ave. Coolidge & Carlson, 89 State St., Boston, archts.

Mass., Fitchburg — Likely Luggage Co., Lydell Ave., Buffalo, N. Y., manufacturers of metal trunks, etc., has acquired a group of buildings here and plans to remodel and improve for main plant.

Mo., St. Louis—Chandeysson Electric Co., 4092 Bingham Ave., awarded contract for the construction of a 1 story addition to plant for the manufacture of plating generators and similar electrical equipment. Estimated cost $65,000.

Mont., Laurel—Northern Pacific Ry. Co., St. Paul, Minn., is having plans prepared for a 110 x 250 ft. car repair shop, here. Estimated cost including equipment $175,000. H. E. Stevens, Ch. Engr.

N. J., Jersey City — Burstyn & Heftler, 209 30th St., Woodcliffe, will receive bids about Oct. 15, for an 8 story garage at Bergen Ave. and Academy St. here. Estimated cost $500,000. Private plans. Noted Aug. 16.

Every one of these items is reported by our authorized correspondents who are instructed to verify every item sent in. This free weekly service is published in the interests of the buyer and the seller, to bring them together and get machinery moving.

Everything possible is done to insure authenticity and timeliness.

Your co-operation is invited in helping us maintain this service at the highest efficiency.

BUSINESS NEWS DEPARTMENT
Tenth Ave. at 36th St., New York

N. J., Lyndhurst (Ind. br. Rutherford)—Bd. of Education, Town Hall, plans the construction of a 2 story addition to high school including manual training shop, etc. on Fern Ave. Estimated cost $350,000. Architect not selected.

N. J., Newark — Pioneer Iron Works, Inc., L. J. Siegler, Pres., 317 Frelinghuysen Ave., plans addition to factory. Estimated cost $30,000.

N. J., Paterson—Wright Aeronautical Corp., 139 Railway Ave., awarded contract for a 2 story foundry on Lewis St. Estimated cost $290,000.

N. Y., Long Island City—F. Benes, 163-18 Jamaica Ave., Jamaica, plans the construction of a 2 story, 75 x 98 ft. garage at 28th Ave. and 31st St. here. Estimated cost $50,000. D. J. Lewison, c/o owner, Archt.

N. Y., Long Island City—Nash Queens Motor Co., 94-30 Merrick Rd., Jamaica, plans the construction of a 3 story, 125 x 168 ft. garage, etc. at Hillside St. and Parsons Blvd. here. Estimated cost $250,000. B. Gunlack, 597 5th Ave., New York, Archt.

N. Y., New York—Bogild Realty Corp., S. Bogdanoff, Pres., 391 East 149th St., plans the construction of a 2 story, 78 x 125 ft. garage at Sheridan Ave. and 156th St. Estimated cost $90,000. W. Shary, 41 Union Sq., Archt.

N. Y., New York—C. Buckley, 2241 Creston Ave. plans the construction of a 2 story, 100 x 100 ft. garage at Haviland and Havemeyer Sts. Estimated cost $60,000. J. J. Dumigan, 2382 Grand Concourse, Archt.

N. Y., New York—Lighthill Corp., c/o T. A. Meyer, 150 East 41st St., is having plans prepared for a 15 story garage at 319 East 39th St. Estimated cost $750,000.

N. Y., New York—Varsity Realty Corp., H. Diamond, Pres., 110 East 42nd St., plans a 2 story, 77 x 130 ft. garage at 158th St. and River Ave. Estimated cost $40,000.

O., Canton—Timken Roller Bearing Co., Dueber Ave. N. W., will receive bids until Sept. 15 for a 3 story, 40 x 100 ft. administration building and chemical laboratory for steel mills on Harrison Ave. S. W. Estimated cost $50,000. R. T. Campbell and R. A. Zenk, 144 West Wood St., Youngstown, Archts.

O., Cincinnati — The Armleder Motor Truck Co., John St., awarded contract for a 3 story factory on John St. Estimated cost $100,000.

O., Cincinnati—I. Hodesh, 529 Rockdale Ave., awarded contract for a 9 story garage on Walnut St. Estimated cost $200,000. Noted Aug. 30.

O., Cincinnati—Chio Pattern Works, Colerain Ave., awarded contract for a 4 story factory. Estimated cost $125,000.

O., Cincinnati—Tennessee Copper Corp., Skillman Rd., awarded contract for a 1 story, 208 x 420 ft. factory. Estimated cost $500,000.

O., Cleveland—Cleveland Wire Spring Co., C. H. Erickson, Mgr., East 49th St., had plans prepared for a 120 x 122 ft. factory and shipping room on East 49th St. Estimated cost $75,000. George S. Rider Co., Century Bldg., Archt. and Engr.

O., Cleveland—Hahn Mfg. Co., 5332 Hamilton Ave., awarded contract for a 1 story, 38 x 73 ft. machine shop. Estimated cost $40,000.

O., Cleveland—Otis Steel Co., 3131 Lakeside Ave., awarded steel contract for open hearth steel ingot furnace, No. 7, to Wellman-Seaver-Morgan Co., 7000 Central Ave. S. E.

O., Dayton—Four Hundred Tire Co., Second and St. Clair Sts. awarded contract for a 2 story auto repair shop and garage at Second and Harries Sts. Estimated cost $56,000.

O., Dayton—The Variety Mfg. Co., 2901 West Third St., awarded contract for a 1 story metal spinning factory on Minerva St. Estimated cost $55,000.

Okla., Sand Springs—Tulsa Rolling Mill Co., Tulsa, plans the construction of a 135 x 432 ft., steel rolling mill including 132 x 135 ft. open hearth building here. Estimated cost $200,000.

Ore., Portland—City is having plans prepared for a 2 story school including manual training shops, etc. Estimated cost $310,000. G. H. Jones, City Hall, Archt.

Pa., Philadelphia — B. Shulman, 1722 Arch St., Archt., is receiving bids for a 3 story, 70 x 186 ft. garage at 20th and Delancey Sts. for Fox Garage. Estimated cost $160,000.

Wis., Stoughton — McNally - Tollefson Foundry Co., J. McNally, Pres., will soon receive bids for addition to foundry. Estimated cost $35,000.

Ont., Walkerville—General Motors Co. of Canada, will soon award contract for a 1 story, 150 x 160 ft. factory on Walker Rd. Estimated cost $5,000,000. Hutton & Soter, 6 James St. S., Hamilton, Archts. Noted Aug. 30.

Que., Coaticook—Gilmour Chair Co. Ltd., awarded contract for the construction of a factory. Estimated cost $80,000.

Que., Montreal—New Brass Ware Co. of Canada, Ltd., 2320 Aird St., awarded contract for the construction of a 43 x 100 ft. addition to factory.